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ON THE EFFECTS OF ARTS, TRADES, AND PROFESSIONS, AS WELL AS HABITS OF LIVING, ON HEALTH AND LONGEVITY.

No. XI.

Lead.—There is no mineral agent to which artisans are exposed, so extensively productive of injury as lead. Its deleterious influence upon animal bodies has also been known from a very remote period. The Roman architect *Vitruvius*, who flourished in the time of Cæsar Augustus, forbids the use of this metal for conducting water, because *ceruse*, he says, is formed on it, which is hurtful to the human body.* Galen also condemns the use of lead pipes; "for," he remarks, "water transmitted through them contracts a muddiness from the lead, and those who drink such water are subject to dysentery."

The practice of using lead in the preparation and for the preservation of wine, had its origin at an early date. Its use became so prevalent in Germany between the years 1498 and 1577, that the emperors issued prohibitory decrees against its use. In the year 1696, several persons in the duchy of Wirtemberg were poisoned in consequence of drinking wine adulterated with *ceruse*, for the purpose of correcting its acidity and harshness. Public attention was thus called to the subject, and

* Vitruv. de Architectura, l. 8, c. 7, ed. 1567, p. 262.

the practice was universally condemned as dangerous, and in some of the German states it was made a capital offence. Several persons were executed, and more fined and imprisoned, for violating this law.*

In 1750, the farmers-general of France discovered that for several years previous 30,000 hogsheads of sour wine were annually brought to Paris, professedly for the purpose of making vinegar, whereas 1200 hogsheads were the usual number imported. It was ascertained, on inquiry, that the vinegar merchants corrected the sourness of the wines by the litharge, and thus made them fit for the markets. The same pernicious practice is still followed in France, where the small tart wines hold out strong temptation for such adulterations. A large proportion of the champaigne imported from that country contains more or less lead, as we have repeatedly tested by experiment. About the year 1572, a very fatal disease appeared in France, called the colic of Poitou, which raged with great violence for 60 or 70 years. This was traced to the adulteration of wine with lead. The lead colic thus derived its scientific name, *colica pictonum*. In 1781 and 1782, almost every individual of three regiments in Jamaica was attacked with an epidemic colic, which, on investigation, was found to arise from the presence of lead in the rum. In Devonshire, Eng., where lead was formerly employed to destroy the acidity of cider, as well as entered into the construction of the cider-house apparatus, this disease was so common as to obtain the name of *Devonshire colic*. "Dr. Mosely," says Good, "was cautioned by Dr. Menghin to avoid all sweet wines whatsoever, but particularly the common tavern wines, upon the road in the Tyrol and in Italy. He never deviated from this advice but once at Viterbo, and then he paid dearly for his indiscretion." All treatises on the preparation of wines recommend *lead* to be added for the purpose of clearing them, and also to stop the progress of ascescence. "The effect," says Accum, "is very rapid, and there appears to be no other method known of *rapidly recovering ropy wines*." In 1723, the Legislature of Massachusetts passed an act prohibiting the use of leaden still-heads and worms in the

* Beckmann "Geschichte," &c. 30, 436.

distillation of spirituous liquors. We have known several cases of accidental poisoning from the action of vegetable acids on the glazing of earthenware, which contains a considerable quantity of oxide of lead. A few years since, a family in Massachusetts, consisting of eight persons, were all seized with spasmodic colic, obstinate costiveness, and vomiting; and the disease was satisfactorily traced to a store of stewed apples, which had been kept some months in an earthen vessel glazed with lead, and which had corroded the glazing. It is not unusual to meet with cases of colic produced by eating pickles kept in glazed earthenware vessels containing vinegar.

The symptoms caused by the introduction of lead into the system are such as indicate inflammation of the alimentary canal, spasm of its muscles, or injury to the nervous system, manifested either in apoplexy or palsy. The irritant effects of this metal, when taken internally, do not properly fall within the scope of this essay.

When the force of the poison is directed chiefly upon the digestive organs, we find the disease ushered in by a deranged state of the stomach, not unlike common dyspepsia, often attended by a sensation of pain or weight in the region of the epigastrium, a weak, small pulse, general languor and weakness of the muscular system, want of appetite, cold, clammy skin, and a tremulous and coated tongue. Nothing now is wanted but some exciting cause, such as exposure to cold or wet, or excess in eating or drinking, to bring on a violent attack. The stomach soon becomes more irritable, and the food is rejected by vomiting; severe pain is experienced over the whole abdomen, which is remittent, and usually alleviated by strong pressure, though in some cases pressure cannot be borne. The pain is of a twisting kind, and felt about the umbilicus; the urine scanty; bowels obstinately constipated; and the muscles of the belly tense, hard, and retracted by spasm. The saliva is increased in quantity, and blueish in color. Severe pains are often felt in the limbs after a few days, and the aspect of the countenance is dull, anxious, and gloomy. Where the poison is directed upon the nervous system, the brain and spinal cord, we have a different train of symptoms. Here there is vertigo,

headache, stupor, and sometimes delirium and epileptic convulsions. The sight is often affected, and in severe cases the disease assumes the character of nervous apoplexy.

Another form of the complaint is palsy of the muscles of animal life, chiefly those of the upper extremities. The power of motion only is lost, while that of sensation is unimpaired. The right arm is also more frequently affected than the left, owing to the circumstance that the poison is more directly applied to it. Emaciation is a common symptom. The loss of power and substance is mostly remarkable in the muscles which supply the thumb and fingers, and in all cases the flexors suffer less than the extensors. The palsy is hardly ever complete except in the extensors of the fingers. The hands are usually bent except when the arms hang straight down by the side; they dangle loose when the patient moves; he cannot extend them, and raises one arm with the aid of the other. There are frequently racking pains in the limbs and arms, the digestion is feeble, and slight causes renew the colic. It was formerly not unusual to see house-painters at work, with the arm half paralyzed; able to grasp the brush, but not to extend the fingers. Sometimes the first symptom is a wasting of the muscles and loss of power, succeeded after a time by colic.

Colica pictonum, embracing the above symptoms or a modification of them, is the only disease which has been traced distinctly to the influence of lead. Other diseases have by different writers been attributed to this cause, but without sufficient grounds. These symptoms, moreover, may be produced by the habitual application of lead to the body in any form, either by inhalation of its fumes, the frequent contact of any of its compounds with the skin, the prolonged use of any of them as internal medicines, or as external lotions or unguents; and especially the accidental introduction of any of them with the food or drinks. Dr. Thomson, however, has undertaken to prove that the morbid influence of this metal is restricted to its *carbonate*, and that its other salts are harmless. We are not entirely satisfied by his arguments that this is the fact, although we have no doubt that the carbonate is the most deleterious form in which lead can be applied to the body, and that the

acetate and sub-acetate are comparatively inert. Dr. Darwin, in his Zoonomia, mentions cases of lead colic produced by the external use of acetate of lead. Sir G. Baker describes a case that occurred under his own notice, where a violent colic was brought on by the use of litharge ointment; and he adds, that children have been thrown into convulsions by the same substance sprinkled on sores. Dr. Stokes, of Dublin, relates an instance where a woman died in consequence of applying a solution of the acetate of lead to a burn affecting the abdominal integuments. Zeller gives the history of a case where symptoms of poisoning were brought on by sprinkling the axilla with the same salt; and Dr. Wall mentions his having seen the bowels affected by Goulard's extract applied to ulcers, and in another paper he describes two cases, in one of which colic was brought on by saturnine lotions applied to a pustular disease, and in the other by immersing the legs twice a day for ten days in a bath of the solution of the acetate of lead. Other instances of a parallel kind might be given, but it is unnecessary. In all such cases, Dr. Thomson attributes the pernicious effects of lead to the carbonate, as the acetate when exposed to the air attracts carbonic acid, and is thus converted into this salt. This assertion, however, requires further proof before we can admit it.

The pernicious effects of lead are experienced also by the lower classes of animals. Dr. Stokes mentions that in the pastures among the lead-hills of Scotland, cows, horses, sheep, dogs and poultry are subject to colic from lead; the symptoms bearing a very close analogy to those of the human subject. In cows, for instance, there was obstinate constipation, with suppression of urine, the animals appearing to suffer from twisting pain of the body, and sometimes were thrown into a state of furious excitement. In this state, nearly one-tenth of the cows exposed to the influence of the metal died. The cows were often hide-bound, attended with panting, starting, and slavering from the mouth. Where the cerebral symptoms were most prominent, the signs of abdominal irritation were by no means distinct. Where the head of the animal appeared much affected, the secretion of milk was stopped. Sheep living among these hills were subject to epileptic convulsions; dogs had the head

principally affected, and ran about slavering at the mouth, as if in a state of hydrophobia. Dr. Stokes mentions that there is one fact which tends to confirm the opinion of Dr. Thomson that the poisonous effects of lead are produced chiefly by the carbonate: A distance of a very few miles from the valley renders animals quite free from any liability to the disease; but if they happen to stray into the immediate neighborhood, and particularly into a portion of low ground, flooded during the winter months by a river, which runs along the valley from the mines, and which in all probability leaves behind an efflorescence of the carbonate of lead, they are very liable to be affected with colic. It is said, also, that the poison is produced by the volatilization of lead in the smelting houses, the vapors of which are carried down the valley and through the neighboring parts. Be this as it may, the Gaelic name of the valley signifies *the poisonous vale;* and as it is very probable that this name had been given in consequence of the deleterious qualities of the place long before the establishment of lead works, it tends strongly to favor the opinion that it is the water which contains the poison. The mode of cure employed by the shepherds in this place is to give strong purgative injections, and remove the cattle from the influence of the poison, by sending them to new and healthy pastures.

Those who suffer chiefly from the pernicious influence of this metal are such persons as are employed in lead mines, those who are engaged in procuring it from its ores, who cast it or manufacture its various preparations, and who use them in the different arts, as plumbers, glaziers, painters in oils or water-colors, color-grinders, type-founders, printers. All persons, however, under certain circumstances, may suffer injurious effects from it. Dr. Good states that lead colic may be produced by sleeping in newly-painted rooms, of which a case occurred in his own practice. The patient was a surgeon of distinction in London. "When I saw him, at his particular request," says Dr. G. "he had been ill for a fortnight; and the cause not having been suspected, his complaint was conceived to be obscure and anomalous. The symptoms, as they struck me, were evidently those of rachialgia from lead; and upon

my pointing out to him my view of the case, I found that about a month antecedently he had sent the whole of his family into the country, as his house was about to undergo a thorough repair in painting, while he himself remained at home and slept there. The cause was admitted and acted upon, but the disease had gained too much ground, and was immovable; his spirits became deeply dejected, and he fell a sacrifice in about two months from the attack." In the Medico-Chirurgical Transactions is a case communicated by Dr. Badely, in which the patient, a domestic in his own house, lost her speech and became paralytic, from being only six hours in a newly-painted room, but quickly recovered from both on being removed.

Merat has furnished some very interesting information respecting the frequency of *colica pictonum* in the various classes of artisans who come in contact with any of the preparations of lead. It is derived from the list kept at the Hospital la Charité, in Paris, in the years 1776 and 1811. The total number in both years was 279; of these, 241 were artisans whose trades exposed them to the poison of lead, viz. 148 painters, 28 plumbers, 16 potters, 15 porcelain makers, 12 lapidaries, 9 color grinders, 3 glass blowers, 2 glaziers, 2 toymen, 2 shoemakers, 1 printer, 1 lead miner, 1 shot manufacturer. Of the remainder, 17 belonged to trades exposed to copper. Of the 279 cases, 24 were under 20 years of age, these being chiefly painter boys not above 15; 113 were between 19 and 30, 66 between 29 and 40, 38 between 39 and 50, 28 between 49 and 60, and 10 above 60. Among the 279 cases, 15 died, or 5.4 per cent.

Although palsy and lead colic are often induced by the application of the compounds of lead to the sound skin, in those trades which compel the workmen to be constantly handling them; and although lead produces a more injurious action upon some constitutions than upon others, (its oxides and sub-salts being more pernicious than its super-acetate) yet the most speedy, and generally the most powerful operation of lead, is, when its oxide is mixed principally with turpentine, for the purposes of house painting. This spirit carries along with it, during its volatilization, a portion of the oxide, and thus poisons the respired air, thereby affecting the respiratory nerves, and

even the blood itself. "Of all exposures," says Christison, "none is more rapid and certain, than breathing the vapors or dust of the preparations of lead. But for that very reason workmen who are so exposed seldom suffer; because the greatness of the risk has led to the discovery of means to avert it, and the openness of the danger renders it easy for the workmen to apply them." Dr. Grisolle of Paris has lately published a treatise on "Diseases produced by the Preparations of Lead," in which he maintains that the action of the *red oxide* of lead upon the nervous system, is both more prompt and more powerful than that of the sub-carbonate; for among the workmen exposed to the action of the former, the nervous symptoms made their appearance much sooner, and were more rapidly fatal, than among those employed in the white-lead factories.

Colica pictonum occurs occasionally among *brassfounders* and other artisans who work with copper; but we are not convinced that it is caused by this metal. It occurs especially among brass-tap makers and glass polishers; but the former mix $\frac{1}{15}$ of lead with the metal, which "sweats out" during the cooling, and is removed by the file and lathe; the latter make use of the oxide of lead as a polishing powder. In these instances, at least, the disease is doubtless to be attributed to the lead.

Miners of lead rarely suffer any injurious effects from their occupation, unless they are also employed in roasting the ore. Mr. Christison states, that at the lead mines in Lancashire, the workmen who dig and pulverize the ore (the sulphuret) although liable to various diseases connected with their profession, and particularly to pectoral complaints, never have lead colic till they also work at the smelting furnaces. The manufacturers of litharge, and of red and white lead, suffer severely from inhaling the fumes from the furnaces, or dust from the pulverizing mills.

"The manufacturers of white lead," says Thackrah, "are subjected to its poison, both by the lungs and the skin. The dust and exhalation are most from the *white beds* and the *packing;* little from *smelting*. There is only stench from the *grinding*, and neither dust nor smell from the *blue beds*. Such, at least, was the statement of the managers at Hull; for we were not

permitted personally to inspect the process, though we examined the men. In several departments, the heat is such as to produce sweating. Drinking, however, is less than in many other hot employments, and white-lead preparers are not as a body intemperate. In all departments, the men and women are sallow and thin, and complain frequently of headache and loss of appetite. The effects of the lead are most marked in the white beds and packing departments. Here men soon complain of headache, drowsiness, sickness, vomiting, griping, obstinate constipation ; and to these succeed colic, or inflammation of the bowels, disorders of the urinary organs, and finally, the most marked of the diseases from lead, palsy. We observed the muscles of the fore-arm more frequently and sooner to suffer than other parts. The eyes are also affected with chronic inflammation, or reduced nervous power. Persons commence the manufacture about the age of 20 ; many soon leave from broken health ; those who endure the employ do not remain on the average longer than the age of 45, and during one-third of these 25 years the men are laid up in bed, decrepid from colic or palsy. The oldest man known in a large establishment at Hull, we found to have attained the age of 54 ; but he is now unable to work. It is 16 years since he entered the employ, and during this period he has been laid up 28 times from serious disease. Each attack has been worse than its predecessor. He has been on one occasion 19 weeks in bed, with scarcely the power of stirring a limb, and was a month without any evacuations from the bowels. This miserable man is now partially paralytic ; he has scarcely any motion in either wrist, and his lower extremities are so weakened that he can scarcely trail himself along even with the aid of a crutch. His haggard countenance and emaciated frame give the appearance of the age of 80 rather than of 54. No person can be a month in the worst department without a serious attack of disease. Drunkards suffer most. One of them was said to have been suddenly seized with violent insanity while packing lead, and to have died soon after. Persons do not work in the lead manufactory more than 5 days a week on the average ; and as no man could be induced to remain in the destructive departments, there is a

regular change of duties. Thus, though none are destroyed, all are exposed in turn to the most baneful process."

No artisans perhaps suffer more in this country from the injurious effects of lead than house-painters; though from the use of proper precautions, they experience far fewer evils from their occupation than formerly. A few years ago we were in the habit of treating some twenty or thirty cases of lead colic or lead palsy annually; but now we hardly see three or four in the same period. On inquiry, we find that the workmen instead of going to their business before breakfast, as they formerly did, are now in the habit of doing no work until after this meal; and they attribute their exemption from the affections peculiar to their employment to this circumstance. When *flatting* or finishing the dead colors with turpentine, there are but few who do not experience some evil effects from the process. The exhalation of the oxide produces dizziness, and sometimes nausea and vomiting, though the former symptom may be occasioned by the stimulating properties of the turpentine vapor. *Grinding* the paint is perhaps a still more dangerous process. Dr. Christison thinks that lead colic is most frequent among painters in cities of the largest size. For example, in Geneva, Switzerland, the disease is almost unknown, and never occurs among painters. In Edinburgh it is also little known. In London, according to the dispensary reports, and in Paris, according to the tables of Merat, many workmen in lead painting suffer. "I have been informed," says Christison, "by an intelligent workman, and a patient of mine, who had been a journeyman painter both in London and Edinburgh, that the number of his acquaintances who had been affected with the colic in the metropolis was incomparably greater than here. This man ascribed the difference to the working hours being more in the former place, so that the men had not leisure enough to make it worth their while to clean themselves carefully in the intervals. This appears a rational explanation." We believe that lead colic is a very rare disease in the country, if not entirely unknown. Plumbers, sheet-lead manufacturers, and lead-pipe makers, are also, for obvious reasons, apt to suffer; but as they are not necessarily exposed to the vapors of lead,

and suffer only in consequence of handling it in the metallic form, it ought to be an easy matter to protect them. They themselves conceive that a very hazardous part of their occupation is the removing the melted lead from the melting pot to make the sheets or pipes; but this operation is not dangerous if the melting pots are properly constructed.

Lead colic occurs occasionally among glass-blowers, glaziers and potters, who use the oxide of lead in their respective manufactures. There are a few cases also among lapidaries and others, who use it for grinding and polishing stones or metals, and among grocers and color men who sell its various preparations. Printers are rarely attacked with the colic, but they are sometimes subject to partial palsy of the hands, which is ascribed to the frequent handling of the types.

The medical treatment of accidents occasioned by the absorption of lead belongs especially to the physician, and cannot be made a matter of discussion in a popular essay; we may, however, offer a few remarks in relation to the best modes of preventing the influence of the poison.

Merat, who has laid down some very useful instructions on this subject, enjoins that particular attention should be paid to cleanliness. He recommends that the working clothes should be made of strong, compact linen, be changed and washed once or twice a week, and be worn as little as possible out of the workshop; a light, impervious cap ought always to be worn on the head while at work. The artisan should never take his meals in the workshop, or without strict ablution of the hands, mouth, and face, and he ought to breakfast before leaving his home. In proof of the importance of cleanliness, *Merat* observes that he knew a potter who contracted the lead colic early in life when he was accustomed to go about very dirty, but for thirty years after had not any return of it, in consequence simply of a scrupulous attention to cleanliness. Frequent bathing is of immense importance to those exposed to the influence of lead, as it is indeed to all artisans, not only from its promoting cleanliness, but also from its tonic effect upon the system. Derangements of the digestive organs ought to be watched with great care. If they appear to arise from the effects of lead, the indi-

vidual should leave off work with the very first symptom, and take an aperient. The diet of the workmen should be nutritive. All acid drinks, such as tart wines and cider, should be avoided. Various articles of diet have been recommended as tending to impede the operation of the poison. *Dehaen* was informed by the proprietor and the physician of a lead mine in Styria, that the work people were once very liable to colic and palsy, but that after they were told by a quack doctor to eat a good deal of fat, especially at breakfast, they were exempt from those diseases for three years. Similar facts respecting the good effects of fat meat, as a preventive of the effects of lead, are recorded by Sir George Baker, Mr. Wilson, and others.

Those who work at furnaces in which lead is smelted, fused, or oxidized, should be protected by a strong draught through them. "The workshop," says Dr. Christison, "should be spacious, and both thoroughly and systematically ventilated, the external air being freely admitted when the weather will allow, and particular currents established, by which floating particles are carried through the workshop in certain invariable and known courses. According to Mr. Braid, wherever furnaces so constructed as to have a strong draught, were built at Lead Hills, the colic disappeared, while it continued to recur where the furnaces were of the old low-chimneyed form. Manufacturers of litharge and red lead used formerly to suffer much in consequence of the furnaces being so constructed as to compel them to inhale the fine dust of the oxides. In drawing the furnaces, the hot material is raked out upon the floor, which is two or three feet below the aperture in the furnace; and the finer particles are therefore driven up and diffused through the apartment. But this obvious danger is now completely averted by a subsidiary chimney which rises in front of the drawing aperture, and through which a strong current of air is attracted from the apartment, the hot material on the ground performing the part of a fire. In white-lead manufactories a very important and simple improvement has been effected of late in some places, by abandoning the practice of dry-grinding. In all manufactories of the kind, the ultimate pulverizing of the white lead has

long been performed under water. But in general the preparatory process of rolling, by which the carbonate is separated from the sheets of lead on which it is formed, continues to be executed dry. This is a very dangerous operation, because the workmen must inhale a great deal of the fine dust of the carbonate. In a white-lead manufactory which formerly existed at Porto Bello, the process was entirely performed under water or with damping; and to this precaution in a great measure was imputed the improvement effected by the proprietor in the health of the workmen, and their superior immunity from disease over those of Hull and other places, where the same precaution is not taken. The only operation latterly considered dangerous at the Porto Bello works was the emptying of the drying stove, and the packing of the white lead in barrels; and the dust diffused in that process was kept down as much as possible by the floor being maintained constantly damp. By these precautions, and by care being taken to make the workmen wash their hands and faces before leaving the works for their meals, and to administer a brisk dose of castor oil on the first appearance of any complaint of the stomach or bowels, the manufacturer succeeded in extirpating the *colica pictonum* entirely for several years."

[For the American Repertory.]

THE CROTON AQUEDUCT.

BY OLIVER SMITH.

The city of New-York is soon to be supplied with water from the Croton river, a mill stream that rises among the highlands of Westchester and Putnam counties, in the state of New-York, and winding its way in a southwestwardly direction, discharges from thirty to fifty millions of gallons daily into the Hudson, a few miles north of Singsing, a village in the same county of Westchester, that has just been spoken of. Across the first mentioned river, and about six miles from its mouth, and nine miles by the road, in a northeastwardly direction from Singsing above named, a dam is now being constructed, the top or lip of which is to be 166 feet above the high tide water at New-

York; and, from the pond thus to be formed, the water is to be conducted upon an inclined plane, (and of course it must be so conducted, if conducted at all, for no locks are admissible in such a case) commencing at an elevation of 153 feet above the tide water aforesaid, and descending generally about fourteen inches in a mile for the distance, including the windings, and its course is very serpentine, of about 33 miles, to the Harlem river, where it will be 120 feet above the same tide water of which we have already spoken; and furthermore, it is still to be continued in various modes, across that river about 9 miles, first to a receiving reservoir which is to hold 158,000,000 gallons, and thence through iron pipes to a distributing one which is to hold 19,000,000 gallons; the latter being something like three miles to the north of the City Hall of the same city above mentioned; and thence it is to be sent again through iron pipes to the houses and other places where it may be required for use. And of this work which is now nearly complete, the expense is likely to be, according to the recent message of the Mayor, about $12,000,000.

The region of country through which this aqueduct passes is very uneven, and notwithstanding every practicable effort was made to avoid hills and valleys in locating it, still many of both were found in its way; so that in constructing it, as may be supposed, several tunnels and many deep cuts were made, and many low places were raised, with earth and masonry, to its level.

The aqueduct proper, or the channel in which the water in this case passes, is constructed thus:—Two walls are erected of common stone masonry, and lined upon their inside with one course of bricks, which rest upon other bricks that are placed edgewise in the form of an inverted arch of nine inches in depression; and these walls, thus constructed of stone masonry and brick lining, are 6 feet and 9 inches apart from the inside of the one to that of the other, and 2 feet 8 inches thick at the bottom; and slope upward 4 inches upon each side to the height of 4 feet, so as to be 7 feet 9 inches apart from inside to inside, and 2 feet thick at the top; and upon them is a semi-circular arch that is 8 inches thick; and above the whole, when com-

pleted, the loose earth is thrown to the depth, or rather altitude, of about 4 feet, to prevent the water which is to run below it from freezing during the winter season. It is not intended that the water shall rise in this case above the spring of the arch above, or top of the side walls of which we have spoken, and which, as we have already said, are 4 feet high; and adding 6 inches as an average for the 9 inches in the depression of the inverted arch that has just been mentioned, we shall have $4\frac{1}{2}$ feet for the height of the water in this aqueduct; and its width being $6\frac{3}{4}$ feet at the bottom, and $7\frac{5}{12}$ feet at the top, will be equivalent to 7 feet; and thus we shall have $31\frac{1}{2}$ or 32 feet at the most for the area of the end of the stream.

Had this aqueduct been constructed wholly of bricks, its form should have been cylindric like that of an ordinary sewer, and the ring or zone should have been one foot thick; but such a structure would have been much more expensive, and no better than might have been the present one with a little variation, which we shall now point out.

In the 2d volume of Hutton's Mathematics, it is shown how piers and walls should be constructed, in order that they may support a given arch; and calculations made pursuant to this demonstration will indicate that the walls of which we have spoken above should have had about *eight* inches more of leverage at the bottom; that is, had their base extended *twelve* instead of *four* inches outwardly beyond their top, their exterior sides thus sloping upward, and their other parts remaining as the same now are, they would have supported the arch and the earth above them; while, as the case actually is, they do not do so, but are pressed with considerable force upon the earth which is thrown up against them. And no harm, it is true, will result from this circumstance where the aqueduct in question is wholly beneath the surface of the ground, for there its walls may, and doubtless have been, actually prevented from spreading in the least, by having the earth that is thrown in between them and the bank beyond trodden and beaten down firmly and compactly; but where there is an embankment the same is not so easily effected. The loose earth that is in this latter case thrown up against the walls, yields more or less as they are pressed

upon it; and contractors and overseers upon this work have told me, that in consequence of the spreading of these walls, many wide openings appear occasionally in the arches above and below; and that they have been obliged to stop the same, and sometimes more than once, with mortar, in order that their work might bear inspection.

This, however, should not be so. A little science, aided by what would have probably been no additional expense at all, would have built those walls so that they would not have spread in any place, whether in case of an embankment or deep cut; while, for the want of that science, the work in question may give way, and nobody knows how soon; and its engineers have no excuse for such ignorance, and especially among the many schoolmasters who are everywhere abroad, and glad to instruct for a respectable living.

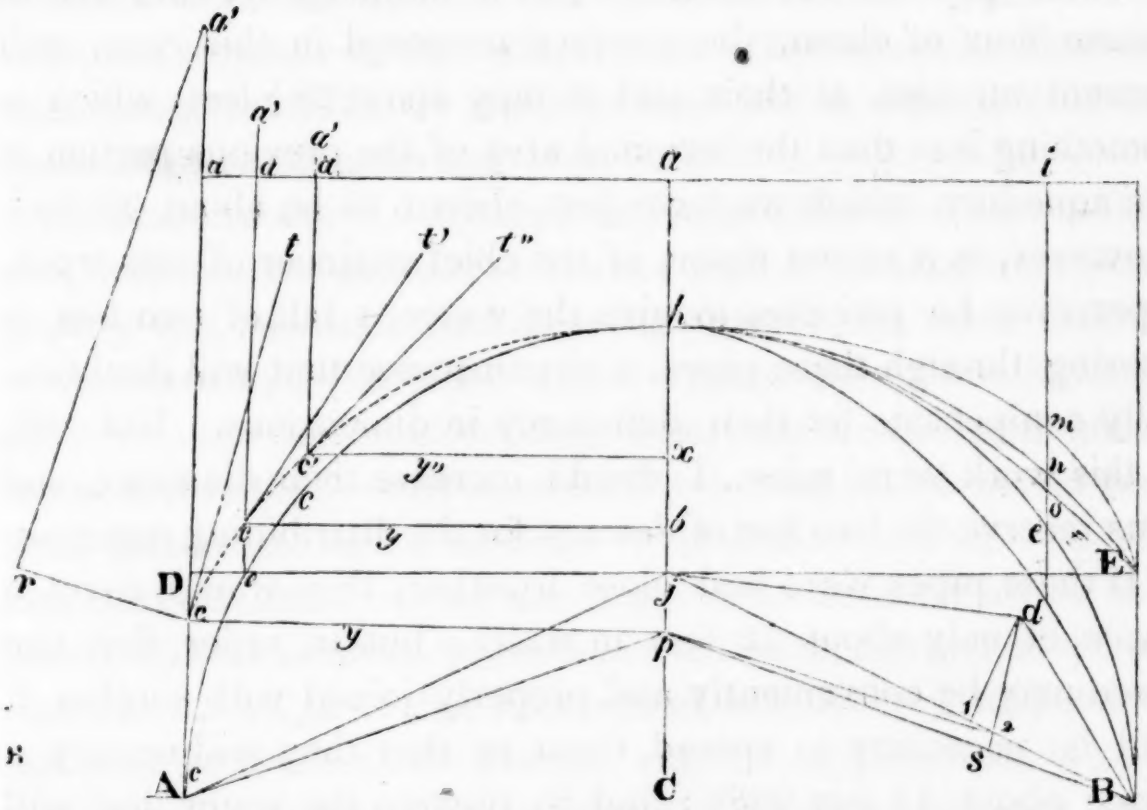
We perceive that from the bottom of the aqueduct to the top or lip of the dam is 13 feet; and that from the highest point to which it can ever be desired to have the water rise in the aqueduct, to the lip of the dam, is 8 feet, if the engineers state correctly; and hence we can readily imagine how a sluice may be constructed that will throw the water into this aqueduct with considerable velocity.

A mile of this aqueduct will contain about 1,250,000 gallons; and it is supposed that the present population of the city will require 7,000,000 gallons of water a day; and hence, if the water fills the aqueduct, and moves at the rate of about six miles a day, it will be sufficient in quantity for the present.

The Croton river is calculated to yield, when rather full than otherwise, about 50,000,000 gallons of water a day; and this, with a velocity of something less than two miles an hour, would all run through the aqueduct; so that as to the dimensions of this channel I have no criticism to offer at present.

Of the structure in question, some of the arches that occur over roads, ravines, &c. are elliptic, while the rest are circular ones; and those for the bridge which is now being erected in the same structure over the Harlem river, are intended, according to the plan which the engineers publicly exhibit, to be semi-circular. These arches are to be 15 in number: eight of

them are to be over the river, and the other seven will be over the low ground which happens to be found upon the north-east or Westchester side of this river. Of the arches over the river, the piers from centre to centre are to be 94 feet apart; and of the others, the piers measured in the same way will be 57 feet apart; making a distance of 1151 feet for the whole bridge, and the same is estimated to cost about $900,000.



A B, the span of the large arches, is to be 80 feet, and of the small ones 50 feet; and C *h*, the elevation in the one case, is to be 25 feet, and in the other 40 feet of course, as we are to have semicircles; and consequently, of the large arches the piers will be 14 feet thick, or in the direction of the bridge at the top, while those of the small ones will be only 7 feet there in that direction.

In order that vessels may pass conveniently upon the Harlem river beneath this bridge, the Legislature of the state have directed that the soffit beneath the crown of the large arches at *h*, shall be at least 100 feet above the surface of the water below it; and this altitude, it will be borne in mind, is about 20 feet below the level of the aqueduct; and to avoid the expense as well as the weight of this 20 feet of structure, it is proposed to conduct the water across this bridge in iron pipes, to be laid in

the form of an inverted siphon: that is, the water will descend into them upon the Westchester side, and rise again to its proper level upon the New-York side of this river, and thus pass on to the city; and in the same manner too, though the circumstance may not be exactly in our way just now, it is to be conducted across a wide and deep valley a little further downward at Manhattanville.

These pipes are to be three feet in diameter within; and of course four of them, the number proposed in this case, will present an area at their end of only about $28\frac{1}{4}$ feet, which is something less than the terminal area of the previous portion of the aqueduct, which we have just shown to be about 32 feet. However, in a recent report of the chief engineer of this work, I perceive he proposes to give the water a fall of two feet in passing through these pipes, a circumstance that will doubtless fully compensate for their deficiency in dimensions. But still, if this work were mine, I should increase their diameter, and thus reserve the two feet of descent for the distributing reservoir.

If these pipes were laid close together, they would cover a space of only about 12 feet in width; but in order that one piece may be conveniently and properly joined with another, it will be necessary to spread them so that they will occupy a space about 15 feet wide; and to prevent the water that will pass through them during the winter season from freezing, it is proposed to have about four feet of earth upon every side of them; so that, on the whole, this bridge must be 26 feet wide, and have an extrade of 12 feet in altitude above the crown at *h*. The spandrel walls, which are to be two feet thick, are to be carried up to the height of *sixteen* feet above the same point at *h*. Here, then, we have two walls, 2 feet thick, 4 feet high, and 1151 feet long, equal to 18,416 feet of solid masonry, for which a light cast-iron railing should be substituted; and it will be readily perceived that this latter guard would be proper, in order to prevent accidents to persons who will naturally visit this work from time to time, and often in crowds.

I observe that the foundation of the piers for the large arches are 26 feet thick, or in the direction of the bridge, and 36 feet wide; but this is suddenly contracted to 20 by 30 feet, which

may be considered as their real base; and their height from the bottom of the river, which we shall suppose to average 20 feet in depth, is 80 feet; so that it will be sufficiently obvious without any calculations just now, that none of these arches will be able to stand alone. Should either of them fall, the whole 15, including all the piers, would follow it, and thus constitute a dam across the river, whose navigation so much expense is now incurred to preserve. But this should not be so. Such a work will be a disgrace to the 19th century. The scientific observer, associating the idea of top-heaviness and a tendency to fall, will almost shudder to look at it.

The hances above *d* are intended to be filled up with masonry that will be two-fifths cavernous; and of course its specific gravity will be about the same as that of the earth and the water including the pipes above it; and hence, we have the simplest case for equilibrating, according to the well known formula to which many contributed, but which seems to have been generalized and completed by Hutton. It is true we have two extrades here. Upon the edges of the arch we are to have one of 16 feet in altitude; and in the centre, another of 12 feet from the crown at *h*; but from actual calculation I find that 13 feet may be taken as an average extrade in this case, without any sensible error; and besides, the intended parapet walls above *a a* should not be made.

Applying the formula above alluded to, we find that if the space B *e h d* B is filled up like the rest above it, the line of pressure or thrust *h d* B, commencing at the crown, will be so situated below the circular curve, that if the line *i d* is drawn perpendicularly downward from the top of the extrade *a a i* to the line of pressure in question, and through the place where the same is the farthest in a perpendicular direction from the circular curve just mentioned, the distance *i d* will be 100, when that of *i e* to the semicircle already referred to is 80.

Now let us suppose the piers to be raised about 20 feet higher, to D and E, and then we shall have an elevation *j h*, of 20 feet; and in this case, the space E *o h n* E being filled up like the rest above it, and the line *i o* drawn as before to the line of pressure, the same *i o* will be 100, when *i n* to the circular

curve is 93; and this arch would be as good for the purpose in question as the other will be; for any concussion that would throw it down would be likely to destroy one of double its elevation and of the same span; and thus we get rid of a large mass of masonry between the curves B *d h* and E *o h*, which for all the arches in question would be worth many thousands of dollars.

If the large arches are semicircles, and if the top of all the piers both of the large and the small ones are brought, as good taste will require, to the same level, it will follow that a large amount of masonry and filling will be necessary upon the small arches, to the amount of 15 feet in altitude, more than will be needed upon the large ones; and hence, by adopting for the latter an elevation of only 20 feet, we shall be making a great improvement, besides dispensing with the wall upon each side, of which we have already spoken.

Along the line of pressure B *dh* in the one case, or E *oh* in the other, should be placed the vousoirs or arch stones; and thus we should have the arch of *equilibration*, which would be pressed in all places alike, and have no tendency to rise up or sink down at one point more than at another.

If the vousoirs are placed along the circular curve B *e h*, the space B *ehd* B not being filled up like the rest above it, then the line of thrust will pass above B *e h*, in the direction *h c' c'* &c. which is represented by the dotted curve on the left, but which is not intended, be it remembered, as a continuation of the circular curve E *n h*.

The equation or locus of the curve *h c' c'* &c. is probably no where given, though it may be readily obtained as follows:— Call $r\,c'=a\,h=13$ in this case, and $a'\,c'=a\,c=w=53$, and the angle at *r* a right one, and *t c' r* being also a right angle, that of *p c' t* will be found to be 73 degrees, the natural tangent of which, radius being 40, will be 173. Now call $h\,p=x$, and $p\,c=y$, and the tangent in question will be $\frac{dx}{dy}$; and in the 2d volume of Hutton's mathematics, page 501 of the edition before me, it is shown that this tangent increases as the weight $w=a'\,c'=a\,c$ does in passing from the crown at *h* to *c' c'* &c. and thus to the

spring; and hence we shall have $dw=C\cdot d\left(\frac{dx}{dy}\right)$; but $w=13$ in this case, when x and y both equal 0; and therefore, $53-13=40=C\cdot 173$; or $C=\frac{40}{173}$; and thus $w-13=\frac{40\,dx}{173dy}$; but $y^2=(40)^2-(53-w)^2$; or $dy=\frac{53-dw-w\,dw}{\sqrt{106w-w^2-1106}}$; or $\int\frac{65\,wdw-w^2-634dw}{\sqrt{106w-w^2-1106}}=\frac{40x}{173}$.

Of this equation, the left-hand side may be integrated in three distinct series; but the numerical calculations thus indicated are formidable enough, and may not be soon made. By taking $y=1, 2, 3,$ &c. successively, and thence obtaining the corresponding values of w however, we can ascertain the respective angles $x\,c'\,t''$, $b\,c'\,t$, $p\,c'\,t$ &c.; $p\,c'$ being an ordinate and $c'\,t$ a tangent to the curve. But however short we may take y, as long as it has any assignable length at all we shall always bring the curve $h\,c'\,c'$ &c. too low down or too near the circular one $h\,c\,c$, &c.; and unless y is taken very short indeed, the circular curve will prove to be the *upper* one of the two. However, in an arch of almost any given curvature, whether circular, elliptic, cycloidal, parabolic, or hyperbolic, whose extrade is of a uniform specific gravity, and raised much above the crown and level upon the top, the line of thrust will pass above the curve; and if a row of vousoirs is placed along this curve, another one should be placed above it in the line $h\,c'\,c'$ &c. of thrust; and hence we perceive that it is merely by *accident* that such arches stand. If the masonry along the curve $h\,c'\,c'$ &c. is strong enough to be a substitute for vousoirs, very well, the arch will stand; but if it yields, as it always does more or less, the crown of the arch will settle down, and the hances will rise up; and if the whole arch does not fall, no thanks are thence due to the architect or the design.

The elliptic curve $h\,m$ E is obviously as far from equilibration as the circular one is; and in all semi-peripheries, whether of a circle, an ellipse &c., the tangent of the angle $x\,c'\,t''$, $b\,c'\,t'$, $p\,c'\,t'$ &c. becomes infinite at the spring or top of the piers, and therefore the weight or w will be so there too; but in the flat arch it never becomes anything, and consequently the thrust in such

cases is always horizontal like that of a wedge; and even in the proper arch the principle is the same; for $a'\,c'$ must effect a pressure in the direction $r\,c'$ toward the centre of curvature, equal to that of $a\,h$ at the crown, and this is analogous to a blow upon the head of a wedge; and the remaining force of $a'\,c'=a\,c$ is in the direction $t\,c'$ upon the pier, and similar to the horizontal thrust of a wedge; so simple is this subject, and even dynamics generally, when properly understood.

Persons who ought to know better tell us about equilibrating an arch by giving a certain form to the vousoirs. Let us look at this a little. The line $d\,1$ being drawn at right angles to Bj, the vousoirs B$\,d\,1$ and $j\,d\,1$ will have no tendency to slide upon each other; and so in all cases the junctures of the vousoirs should tend toward the centre of the curvature of the line of thrust in an arch, or so as to fall at right angles to a line drawn from one juncture to another, when straight bars are put together end to end, as B$\,d$, $d\,j$, j A. If the vousoirs are in the form, however, of B$\,d\,2$ and $j\,d\,2$, they will have a tendency to slide upon each other, though their mutual friction may prevent their actual sliding.

Now draw B$\,p$ perpendicular to $d\,2$, continued to s, and then alter the intrade or line of thrust to B$\,2$, $2\,p$, pA, and the vousoirs B$\,2\,s$ and $p\,2\,s$ will have no tendency to slide upon each other; but this and every other variation of the intrade will require a corresponding variation of the extrade; and those who tell us about making the same extrade suitable for any intrade whatever, merely by giving what they call the "*proper form to the vousoirs*," talk very foolishly, to say the best of them; and Hutton and Gregory speak of them with much contempt.

It is equally foolish to attempt to equilibrate an arch in an experimental manner, by hanging weights upon a chain that is attached at both ends so as to hang loosely, and thus to form a curve. The thing is wholly impracticable; for there is only one chance among an infinite number that the experimenter will succeed in his efforts. In short, as Hutton and Gregory, and many others assure us, there is but one practicable method of equilibrating an arch; and that is, first, to know the extrade span and elevation, and from thence to calculate the line of

thrust, and there to place the vousoirs. The operation is simple and easily effected; and it is surprising to me, at least, that so few understand it. Many who pass for good dynamicians will preach a long lecture about a certain "*friction*," which none, as they contend, but the practical builder can possibly appreciate. As to this "*friction*," however, I have just said all substantially that is to be said about it; and if those who pretend to be able to think cannot understand it, how can those do so who never think at all?

Again, we are lectured about cutting the vousoirs *properly*. Upon this point, too, I have just stated all that the practical builder or any one else understands or knows, and all that exists; and if those who call themselves dynamicians do not comprehend it, I should like to know what they do comprehend.

But I am reminded that circular and elliptic arches are found to stand. True, they do so generally, though they sometimes fail; and I have just given the reason why they do either. How foolish it is to place the vousoirs where they will be of no use whatever, and then to substitute loose masonry for them where the true ones should be! But the peasant would persist in putting a stone at the mouth of his bag, to balance the grain at the bottom of it, whenever he had occasion to carry that grain at all, because his ancestors had done so before him; and equally bigoted, ignorant and foolish are mechanics now in erecting any arch but the one that is calculated from the span elevation and extrade.

It is true that a circular or elliptic arch over a door or window in the side of a building, is just as good as the calculated one; and that, too, because the masonry, where the line of thrust actually passes, in such a case is equally firm as is that which consists of vousoirs; but the same is not generally true in the arch of a bridge.

Let the large arches under consideration be divested of the parapet walls of which we have already spoken; let them have a moderate elevation, and be equilibrated; and let the piers upon which they are to stand be extended to 40 feet at their base, and be contracted to 6 feet at the top, in the direction of the bridge, and let them be three-fifths cavernous; and any two

of them will support the arch that is to rest upon them. Thus constructed, their thickness would be equivalent to 23 feet; while that of those which are now being erected is 17 feet. Three-fifths of the latter is $10\frac{1}{5}$, and two-fifths of the former is $9\frac{1}{5}$. Thus my piers would contain less masonry than will those which are now intended. Making mine one-half cavernous, their solid contents would be to that of the intended ones as $11\frac{1}{2}$ to $10\frac{1}{5}$. But I should have 1524 feet of solid masonry for each pier from the parapet walls, for which I have proposed above to substitute an iron railing, and this would enable me to make my piers about as solid as the intended ones are to be.

Again, placing the vousoirs where they should be, along the line of thrust in these arches, I would obviate the necessity of all that masonry which is intended to be put upon the hances and top of the piers as a substitute for vousoirs; and thus by putting loose earth, or nothing at all in its place, I would save in each of those arches about 10,000 cubic feet of solid masonry, which would be equal to about one-half of one of the intended piers! Look at this! What pains are taken to make the piers in this case slender, and the arches heavy—uselessly, ridiculously, nay even frightfully heavy!

But again, have one pipe of about $6\frac{1}{2}$ feet in diameter, instead of four that are each 3 feet in diameter, for conducting the water across this bridge; and then the arches in question, and consequently the whole structure, piers and all, may be reduced from 26 to about 15 feet in width—nearly one-half! and even then this pipe would have as much earth and stone at its sides as will the exterior ones in the plan proposed. But this is not all. Instead of surrounding this pipe with earth to the thickness of 4 or 5 feet, inclose it in an air-tight case, and then it will not be necessary to make this bridge more than ten feet wide for one foot in thickness, if confined air will prevent the water in question from freezing. We all *know* this to be so, and it is *criminal* to pretend that we do not. We ought to raise our voices in defence of science, which is treated with so much contempt in this case. Any fluid, whether liquid or gaseous, will take caloric very readily from any substance with which it comes in actual contact, and will yield the same again with

equal readiness to any substance with which it happens to meet; though it radiates or emits caloric very slowly, if at all. It is a good transporter, in case it has its liberty, but a bad radiator or conductor of caloric; and hence, if properly confined, it becomes a better insulator of caloric than is anything else.

No other use can ever be made of this bridge than to conduct the water in question across it, and for this purpose solely should it be erected. The piers should have a large base and a small top, and be very cavernous. Upon them light arches should be placed about ten feet wide, and upon these arches should be laid an iron pipe about $6\frac{1}{2}$ feet in diameter within; and this pipe should be inclosed in an air-tight brick case, whose walls should be only eight inches thick; and one foot is distance enough for their inside to be from the pipe. And the water thus protected could never freeze while passing across this bridge. But as a further precaution, I would build an oven in the chamber which is to contain the influent water upon the Westchester side of this river, and in this oven a fire could be made during cold weather, and thus communicate all its caloric to the water; but no such fire would ever be required. And thus we could have a bridge with equilibrated arches that would stand alone, for less than one-half of what it will now cost for one with arches that will not be equilibrated and will not stand alone! But in case of an earthquake, or a small failure in its materials, it will dam the river, and cease to bear water to this city. And why should we pay $900,000 for a bridge in this case, when we can have one so much better for about $300,000?

Stones of all kinds, it is well known, are subject more or less to disintegration and decomposition; and that it is within the sphere of possibilities that some one of these arches may fall, and that too within a few hundred years; and every one will readily imagine that if such a catastrophe should occur while human inhabitants remain upon this island, they will look back and wish that the work in question had been differently constructed.

We should not now, in the nineteenth century, put up such a bridge, and especially when the proper one can be made for less than half the money. To do so is an outrage upon the

science of the day. Future generations will think we were crazy, for they will be certainly aware that we ought to have known better.

Mr. Frost, a very ingenious mechanic of Brooklyn, N. Y. has suggested another method for building this bridge: "Have no arches or pipes; but instead of them, lay from pier to pier a trough made of *cast* iron plates. These plates should be 10 feet long, 6 feet wide, and $1\frac{1}{2}$ inches thick; and they might be put together very firmly, end to end, without any *wrought* iron fastenings; and the side plates thus fastened, and standing as they would be edgewise, would support the stream of water that would pass between them. But this trough might be braced with cast-iron bars running to the piers; and let it be inclosed in another one made air tight; and this would add its own strength to the first, and prevent the water in the same from freezing. In this case the piers should be just wide enough apart so that any vessel might pass conveniently between them, and should be raised 120 feet, to the level of the aqueduct. They should be hollow and light, like a shot tower, though their base should be large enough to enable them to stand firmly, and especially in the direction with the river; and they might be bound together with bars of iron, running up endwise in their sides, so that they would never break off; for we would not have their crust or rind more than two feet thick."

This would be certainly a very cheap and permanent method of conducting the water across the river in question.

THEODORE STRONG, Esq. *Professor of Mathematics, &c. in Rutgers College, N. J.*

SIR—Considering you as about the first analyst that we have in the country, and equal to any in the world, and being much indebted to you for aid in my mathematical researches, and particularly in this very article, I would request your attention to the same, knowing you will promptly detect any fallacy that may exist in it. And be assured of my great respect and affection.

O. S.

[For the American Repertory.]

New Theory; suggesting the Rotary Motion of the Earth as the Cause of its Curvilinear Direction in its Orbit, and also of the Tides. *By* LEWIS MASQUERIER.

It is said in treatises upon gunnery, that if a rotary motion is given to a ball around an axis at right angles to its progressive course, it will be deflected into a curvilinear direction. If it rotates around an axis horizontal to the earth, and downwards in its fore part, it will strike under the mark; but if it rotates upwards, it will strike above. If it rotates around a vertical axis from left to right, it will hit to the right of the target; but if it revolves from right to left, it will strike to the left; and so on with every intermediate position of its axis.

Now, it seems from this uncertainty of the direction of balls shot from smooth-bore pieces, that the rifle gun has been invented, with four or five spiral grooves going round once or twice from the touchhole to the muzzle. By this ingenious device a rotary motion is given to the ball around an axis, with one of its poles pointing in the direction of the mark, by which much closer shooting is attained.

If military projectiles are thus deflected by a rotary motion, why would not the rotary motion of the earth, on the same principle, cause its curvilinear direction in its orbit, whether it moves through a plenum or a vacuum? Now, all the planets and satellites (with the exception of those of Herschel) both progress in their orbits and rotate on their axes, from west to east—the very direction this theory requires. Recollect, the rotary motion is in the direction with the progressive at the night, and the contrary direction at the day meridian; and it is at right angles with it, at the morning and evening points of the earth. Hence, this rotary motion has a *leverage* upon the progressive.

According to this theory of deflection, the rotary motion of the earth alone, in concert with the progressive, seems to be sufficient both to *sustain* and to *retain* it in its orbit, independent of any attractive influence by the sun; which, it would seem, may impede instead of facilitating its motions. If this theory

should require that the planets ought to move with an equable velocity in their progressive as well as rotary motions, it will give them circular instead of elliptical orbits; and the placing of the sun a little out of the centre of their orbits will perhaps sufficiently account for the cause of the sun being eight days longer in going through one half of its orbit than the other.

But the small rotary motion of the moon may be thought not sufficient to deflect it in its progressive course; which may be obviated by supposing that the earth and moon are at different distances from each other and the sun than computed by the Newtonians. But this difficulty cannot be greater than theirs, that the planets revolve around the sun while it is continually attracting them at right angles, without destroying their projectile velocity.

But the rotary motion of the earth may not only cause its curvilinear direction in its orbit, but it also may be the real cause of the tides. Why should the Newtonians go off to the moon and sun for the *far-fetched* cause of attraction for the tides, and overlook the *near* cause of the immense whirl of the earth? Is it possible that this great rotary and progressive motion of the earth should have no power even to undulate the ocean a little, and cause the tides? The fact that there is a general motion of the seas from east to west, contrary to the rotary motion from west to east, proves that the solid matter of the earth leaves the liquid a little behind; that is, the upper part of the ocean at the rate of 5 or 10 miles behind. With the fact, too, before their eyes that the rotary motion of the earth has thrown out its matter at the equator by its centrifugal force, so that its equatorial is 34 miles longer than its polar diameter, they seem not to have thought that these motions should also throw out the water at the meridian sides of the earth, and cause the high tides; and at the morning and evening points, the low tides; that is, if the whole surface of the earth was covered with water of an equal depth. But in consequence of the large continents extending north and south, and causing the water to rebound, it is retarded about three-quarters of an hour every day; and thus they modify the time of the tides through the 24 hours. It is well known that funnel-mouthed rivers and bays collect

the waters, and raise higher tides; but about islands in the centre of large oceans, the tides only rise from 12 to 18 inches, and come on nearer the meridian; and thus prove the agency of the rotary motion in causing them.

This theory I have entertained for twelve years; but despairing of ever getting the time or means of elaborating it, I hereby submit it to the consideration of the more fortunate cultivators of the science.

[For the American Repertory.]

In replying again to your persevering correspondent "On the Steam-Engine," I have a task to perform by no means agreeable, since his communications have now assumed a form which compels me to expose with less reserve than I should wish his deficient knowledge of even the first principles of physical science, least to be excused in one who is so remarkable not not only for the pertinacity with which he thrusts his erroneous notions before the public, but for the acrimony which he resorts to in every instance where correct reasoning and fair argument fail to support his views. Whilst confined to abstract opinions, however absurd, his communications were of little moment; but not so now that he makes the pages of the Repertory a vehicle for the dissemination of the most incorrect statements on a variety of subjects of public importance.

The confused style and reasoning peculiar to your correspondent makes it almost impossible to disprove his statements in the order they appear. I must therefore divide the subject of his communication under five heads, viz :—1. Resistance of fluids to bodies.—2. Comparison between the Great Western and the North America.—3. The Ericsson propeller, the Clarion, high and low pressure steam.—4. Alledged perfection of the common paddle-wheel and of the Archimedean screw.—5. Latent heat of steam.

I. *Resistance of Fluids.*

Your correspondent's mode of "extricating this matter from its *utter confusion*," by the toy he calls "two model boats," is

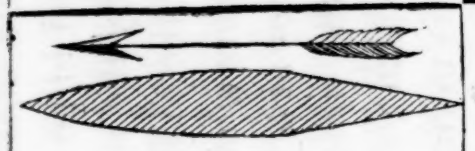
sufficiently ludicrous; but his deductions, based on imaginary results, and tending to establish laws at variance with the common property of matter, really makes it difficult to treat his communication with becoming gravity. We are told that "the *speed* or space passed over by the respective boats in the *same time* increased *exactly as the weights were increased;*" and also that "while one boat, drawn by a given weight, passed over a measured space, the other similar boat, drawn by a weight *twice as heavy* as the weight attached to the first boat, passed exactly over *twice the measured space* in the *same time* as the first boat." It is not my province to point out what particular blunder in the mode of conducting these miniature experiments has led to such preposterous results; though I cannot refrain from adverting to the singular credulity—not to mark the ignorance—of the experimentalist in believing in them; circumstances only equaled by the folly of placing such nonsense before the public.

It would be waste of time to enter into any lengthened mathematical discussion on a subject set at rest by eminent philosophers, and even taught in common schools, centuries ago; I will therefore only detain the reader by recapitulating the following well-known law in hydrostatics:

If any body move through a fluid at rest, or the fluid move against the body at rest; the force or resistance of the fluid against the body will be as the square of the velocity and the density of the fluid.

"For the force or resistance is as the quantity of matter or particles struck, and the velocity with which they are struck. But the quantity or number of particles struck, in any time, are as the velocity and the density of the fluid. *Therefore the resistance or force of the fluid is as the density and square of the velocity.*"

To those who prefer the test of actual experiment to theoretical deduction, the following extract from the tables of the results of the experiments of Col. Beaufoy will perhaps be more satisfactory. The scale on which these experiments were conducted, the extreme accuracy observed, the ample means possessed by, and the extraordinary devotedness to the science and the perseverance of the experimentalist, are certain guaranties that the results may be depended upon.

FORM OF BODY.	FEET PER SECOND.											
	1	2	3	4	5	6	7	8	9	10	11	12
	0.2229	0.9245	2.1042	3.751	5.856	8.403	11.381	14.777	18.577	22.776	27.36	32.31
	0.3287	1.2712	2.7565	4.726	7.128	9.917	13.052	16.498	20.213	24.172	28.34	32.69
	0.2845	1.1348	2.5147	4.389	6.724	9.488	12.657	16.202	19.927	24.111	28.59	33.35
	0.2836	1.1392	2.5434	4.462	6.867	9.730	13.030	16.741	20.828	25.296	30.11	35.25
	0.3798	1.4949	3.2870	5.705	8.703	12.238	16.275	20.779	25.712	31.06	36.77	42.83
	0.2617	1.0539	2.3457	4.107	6.309	8.927	11.935	15.310	19.028	23.023	27.42	32.05

The amounts given in the above table show the resistances expressed in pounds to each square foot of sectional area presented by the respective bodies; and the sums of these resistances at the different velocities prove that the *resistance increases as the square of the velocity*. Take, for instance, the sums of the resistances at 3 feet per second on 15.55; compare this to the sum of the resistances at 6 feet per second on 58.70, which comes within $\frac{1}{17}$ of the theoretical quantity; an approximation so close as to remove all doubt as to the accuracy of the established law questioned by your correspondent, but acknowledged by all who possess any information on the subject.

Referring to the foregoing demonstration, I submit to your readers whether the untruth of the assertion "that the fuel is twice as efficient in the Great Western as in the North America," has been rendered less palpable by the inaccurate experiment instituted by your correspondent. A sense of justice, therefore, induces me again to state that the power of the North America's engines absolutely exceeds that of the Great Western, and that the consumption of 24 tons of anthracite coals in the former actually produces a greater effect than 28 tons of bituminous coals in the latter; these facts being deduced entirely from your correspondent's own premises in the matter. (See vol. iii, pp. 32 and 33.) J. E.

(TO BE CONTINUED.)

LETTER TO THE EDITOR.

Prof. J. J. MAPES:

Dear Sir—Among the numerous advantages afforded a student in mechanics by your valuable journal, the ready means it offers for the proposition and solution of any difficulty which may occur in the course of his reading or practice is to be estimated among the most important. In view of this often recorded proof of a desire on your part to give the requisite aid and information to such as may come to ask for instruction, I shall feel safe in venturing to bring such subjects under your friendly notice as may to my mind require elucidation or explanation.

It has fallen in my way lately to consider the nature and uses of the "*universal joint*," invented by Dr. Hook; and although its general description is readily obtained from treatises on mechanics, yet, after some inquiry, I have not succeeded in obtaining sufficiently definite information on the points touched upon in the annexed queries. As the joint appears to be rarely employed except for light work, I am desirous of knowing:

1. Whether it can be advantageously employed to conduct the amount of power derived from a 25 or 30 horse engine?

2. Whether it is durable and not easily deranged, nor liable to get out of working order?

3. How much may the shafts be varied from a straight line, without materially injuring the action of the joint?

4. In what may principally be found the loss, if any, arising from an extreme deviation of the shaft from a straight line?

5. Whether a *single joint* connecting two shafts, at a given angle with each other, produces an irregular motion on the shafts? and if so, whether *two joints*, connecting the two shafts by an intermediate one, will, by a counterbalancing action, rectify or neutralize the error, and give a regular motion at the two extremes? W.

NATIONAL ACADEMY OF DESIGN.

REVIEW OF THE EXHIBITION.

(CONTINUED.)

14. *Portrait of a Lady; by F. Alexander, H.* Painted in a high scale of color, is extremely warm in tone, and does great credit to the artist, with the exception of the back ground, of which we cannot approve. Nos. 30, 111, and 146, by the same artist, are pictures of great merit.

15. *View on the Hudson, looking up from Poughkeepsie; by W. J. Jewitt.* There is much merit in the intention of this landscape, but it wants ease in the manipulation.

16. *Portrait of a Young Lady; by E. D. Marchant, A.* A fine, round head, full of warm pleasing tones, but slightly metallic in the high lights.

17. *Portrait of a Gentleman; by A. B. Durand*, N. A. Strong individuality, with correct drawing, for which excellencies this artist has long enjoyed a high and well deserved reputation.

18. *Portrait of a Young Gentleman; by S. A. Mount*, A. Unique and fearless position; the hand would do credit to many an artist who holds the highest rank in his profession.

19. *Portrait of the Rev. Dr. L. Beecher; by E. D. Marchant*, A. A strong, good head, and free from the objections made to No. 16.

21. *Portrait of a Lady; by W. Page*, N. A. As a whole, we have never seen a better portrait. The texture of the skin is so precisely imitated, that it is difficult to persuade one's self of its want of identity; the hands are most accurately drawn, and show the peculiar appearances of age with great truth. The quiet nonchalance of the sitter, and the peculiar accessaries, are so perfectly represented, as to rid the work of the appearance of a picture—nature's self really appears to occupy the frame.

We are glad in having an opportunity of referring to Mr. Page's works, and shall take the liberty of expressing our views of them fearlessly.

The first truly good picture by this artist was exhibited at Clinton Hall, about five years since, and will long be known under its then cognomen of "The Mother and Child." The sudden appearance of this work, by an artist at that time but little known, created more surprise than had been felt for any other since the establishment of the Academy, and consequently the strongest hopes were entertained that his future efforts would far surpass even this favored specimen. For two or three years, Mr. Page met the anticipations of his friends, and all awarded the most unqualified praise. But last year the scene changed; he exhibited a picture of a female standing in broad daylight, almost without shadow. This work really puzzled the critics: it had many admirers and many fault finders; but neither admirers nor fault finders were able so to describe their views of its merits or demerits as to be understood, and even its opponents were undecided whether the talent of the artist had surpassed their comprehension by the novelty and

previously untried peculiarity of his design, or whether it was really faulty.

No. 21, of which we have spoken above, bears no resemblance to his former works, and although entirely superior to his previous efforts, would never be recognized as emanating from the same pencil. Nos. 135, 142, and 237, also in the present exhibition, are painted in an entirely different style: they are cold even to blueness, and consequently unattractive. With all these objections, they contain merits of a high order; and again he has puzzled the critics. The casual observer condemns them at once, while he who peruses them attentively finds beauties almost sufficient to remove his doubts of their propriety. Mr. Page has, by his various manners or styles, obtained the appellation of the experimental painter; and perhaps his course may eventually prove beneficial to him, provided his object in these experiments is to obtain such negative results as shall regulate his future style. But he is mistaken when he exhibits them; for whatever may be the excellencies of Nos. 135, 142, and 237, had he exhibited No. 21 alone, his merits would have been better understood and appreciated.

22. *Columbus before the Council of Salamanca; by R. W. Weir*, N. A. Mr. Weir has certainly well earned his high reputation, and his compositions are proofs that he soars far above mere manipulation and academic correctness. This composition belongs to a high class of art, and fully achieves all it attempts. The claire-obscure is so managed as to produce quiet without loss of grandeur. The accessaries are accurately painted, and the whole effect pleasing and forcible. The figure of Columbus we cannot admire as equal to the rest of the picture.

25. *Group of Children; by H. Inman*, N. A. We cannot help the feeling that praising Inman is useless; he has so long held first place in his particular line of art, that this fact alone makes either the praises or censures of criticism alike useless and harmless to his fame. A fortunate picture by a younger artist is always compared with his; but when we look back over his works for a series of years, and find them steadily improving; with an unqualifiedly high reputation for all, and not part of his pictures, it leaves him still the favorite, at least of our city.

No. 25 is painted in a good scheme of color; the difference in the complexion of the two children is most accurately and artistically delineated. It is entirely superior to No. 10.

26. *Group of three Ladies; by H. Inman*, N. A. A well composed and very effective picture.

27. *Mercy's Dream; by D. Huntington*, N. A. This gentleman has made himself, by sheer merit, a feature of the exhibition; and this picture is sufficient to insure his continuance in well deserved favor. It is truly a *blissful reverie.* The figure and face of Mercy are transcendantly beautiful, and fully convey the fine classic taste of the artist. If the picture have any faults, they are academic and unworthy of notice. We are informed that Mr. Carey, of Philadelphia, so well known as a liberal encourager of native talent, has purchased this picture for 700 dollars.

28. *Landscape View in Sullivan County, N. Y.; by H. Inman*, N. A. The only objection we have heard made to this picture is that the foliage is too green. We cannot help think that this arises from its comparison with other pictures rather than with nature. It has long been a fault with our landscape painters to approach the gorgeous beauties of the American autumnal tints even in their midsummer pictures; forgetting that ever beautiful nature can have charms when in her most healthy state; and although more difficult to represent than when assisted by variety of tones such as usually mark her decay, still, when succeeded in, entitle the artist to our warmest praise.

33. *Portrait of the Hon. D. Cady; by F. Fink*, H. A good portrait, with much warmth and strength.

34. *John Anderson my Joe; by W. R. Hamilton*, A. The still life parts of this picture are good, but the figures remind us strongly of Thom's statues, in Scotch sandstone, of Tam O'-Shanter, &c. and are very much the same tone of color.

37. *Portrait of J. H. Caldwell, Esq.; by E. D. Marchant*, A. This is an excellent likeness, and really appears to convey the very character of the original. Mr. Marchant appears to be peculiarly accurate in likeness; his portraits of Harrison, Clay, Adams and others are strong proofs in his favor.

40. *The Yankee Pedlar; by J. R. Bleecker.* Why this attempt

should have been admitted is difficult to understand. It is entirely void of merit or humor.

41. *Portrait of a Gentleman; by Miss J. Stewart.* If gallantry did not forbid, we should feel compelled to find much fault with this attempt. It appears to have been copied from a varnished *papier maché* head of a lay figure, as it does not show the slightest trace of mortality.

46. *Fourth of July; J. G. Clonney*, A. A difficult and well composed picture. Mr. Clonney has painted little, but evidently with much thought. He is so well versed in the grammar of his art, drawing, that all faults, if any exist, are forgotten in the admiration of the accurately drawn and well-studied forms which compose his groups. He still requires practice in coloring; but with his evidently close habits of observation, he will soon master color as he has form. The shadows on the ground are too warm; the cold sky represented in the picture does not warrant the tone of the shadows.

47. *The Village Doctor; by T. H. Matterson.* Nothing like Wilkie.

48. *Portrait of Achmet Ben Aman; by E. Mooney*, N. A. An admirable picture. As a likeness, it is unexceptionable; the details are accurately painted, and notwithstanding that the complexion is very unusual, the artist has produced a rotundity to the head which does him great credit. This production has the rare merit of being in perfect tone.

49. *Portrait of a Lady; by J. Whitehorne*, N. A. Some parts of this picture surpass the artist's former productions; but we feel compelled to say that the left hand is not well drawn; and both hands, notwithstanding their difference in position, are in the same tone of color.

51. *Portrait of a Gentleman; by W. J. Jewitt.* The back ground of this picture contains too much. It is a general fault with beginners to crowd their pictures, and divert the eye from the principal object.

52. *Boy and Dog; by W. R. Hamilton*, A. This artist's pictures have some beauties, but more faults. The dresses appear fresh and clean from the hands of the washwoman, well starched and nicely mangled; the very trees and other accessaries have

the appearance of precise preparation for the artist; and the dog in this picture would puzzle a naturalist to decide its class.

52. *Cider Making; by W. S. Mount*, N. A. A characteristic composition, so closely painted to nature that its location is readily discovered to be Suffolk county. Every figure gives evidence of its intention, and all the details are brought into active requisition to compose the grand whole.

54. *The Stump Candidate; by J. Hagan.* Without merit. Every figure badly drawn, and void of interest.

55. *Portrait of a Lady; by C. C. Ingham*, N. A. We have before had occasion to say that Mr. Ingham's female portraits stand alone for delicacy and truth of finish. It has become fashionable to find fault with highly finished pictures, from the fact that in most cases extreme finish does away with force, weakens identity of forms, and produces polished surfaces too smooth for nature. This is not the case with Mr. Ingham's female portraits. His drawing is faultless, and with his judgment, experience and talent, only tends to perfect his picture in all its parts. Nos. 157 and 217 are truly masterpieces.

61. *Cascade on the Catskill; by E. Verbryck*, A. This artist has much merit; several of his pictures have long held a good reputation; but we much prefer some of his other works in the exhibition to No. 61.

62. *Portrait of a Girl; by J. Whitehorne*, N. A. A good portrait, evidently from nature, and free from the faults of No. 49.

66. *Portrait of a Lady; by J. H. Shegogue.* A good design. Mr. Shegogue occasionally produces a portrait so well arranged as to position of the figure, &c. as to entitle it to the appellation of a composition. Both this picture and 67 do him much credit.

70. *Portrait of a Child; by C. C. Ingham*, N. A. The head is inimitably expressive; the lower limbs have a haziness which we do not understand; and the back ground is not in this artist's usually effective style.

72. *Sea Piece; by E. H. Ludlow.* Entirely wanting in aërial perspective. It is really difficult to judge the relative distances of parts in this picture.

74. *Portrait of a Lady; by J. H. Shegogue.* The artist has displayed good judgment in the selection of the attitude of the figure.

78. *Boy and Rabbit: by J. Whitehorne*, N. A. The artist's best head; the hands, however, are carelessly painted.

79. *Portrait of a Boy: by W. J. Jewitt.* Good design, and quiet tone about the head. The drapery and fore ground should have been painted from nature.

80. *Portrait of a Lady: by G. C. Thompson.* Face and hair fairly painted: the sky positively bad.

83. *Portrait of himself: by J. D. Blondel.* An excellent head. This artist has a style peculiar to himself; and with such industry as we know him to possess, will undoubtedly succeed.

85. *Portrait of the Hon. P. R. Livingston: by W. H. Powell*, A. This picture is full of merit, and of a very high character. Mr. Powell has a fine appreciation for beautiful arrangement of color, and did he pay as much attention to delineation of minutiæ and to general effect, making his picture less sketchy, he would achieve any place in his art which he might desire.

86. *Portrait of a Gentleman: by Chev. Jos. Patania.* Painted in the style of the modern Italian school. Many parts of this and No. 99 are truly beautiful; but from want of tone and proper arrangement of color the whole is passed by unnoticed. This picture was painted in Italy; and we cannot understand why an artist, residing where he is surrounded by the works of Titian and other masters, should select his colors without reference to truth, and produce such cold, unnatural and unmeaning tones. The picture or window along side the figure—for we are unable to decide whether it is intended for a picture or a window—produces a hard line and angle, which destroys it as a composition.

90. *Landscape: by M. Livingston.* Evidently by an amateur.

91. *The Boyish Reverie: by W. H. Powell.* A glowing *peachy* specimen of coloring. The shoes and stockings are evidently painted from nature: were all the accessaries so painted, it would be truly a great picture. The rock surrounding the head in the picture should have been more broken: its intention to relieve the head would not then have been so evident, and it would more perfectly have accomplished its intention.

98. *Portrait of a Lady in a Riding Dress: by H. Inman*, N. A. We are glad to see that Mr. Inman sets so good an example to

his juniors: even the gloves in this picture are painted from nature: in other respects it is in his felicitous style.

103. *The Novel Reader: by T. H. Matterson.* Mr. Edmonds has many admirers, but few equals.

104. *Landscape, an Autumn Evening: by J. R. Bleecker.* An attempt to paint an autumnal scene.

110. *Landscape: by T. Cole*, N. A. The sky and distance are exquisite, and the fore ground in Mr. Cole's usually forcible style.

111. *Portrait of a Lady: by F. Alexander*, H. A fearless and successful design, beautifully colored.

113. *Christmas Presents: by E. W. Goodwin.* If by a beginner, is more than creditable, full of promise, and evidently painted from nature. The drapery of the centre figure is very good; the neck shows strong talent, and fearless desire to copy nature without following the plans of others.

121. *Portrait of a Young Lady: by S. A. Mount*, A. This artist has many very excellent pictures in this exhibition, and has evidently been a close student since the last: they are characterized by clearness of shadows and quiet tone of color. His likeness of W. S. Mount, N. A. (No. 126) is inimitably like.

122. *Hudson River Scenery: by J. P. Beaumont.* Draggled, dreamy and unnatural: a broken world in a kaleidescope.

147. *Landscape: by R. W. Weir*, N. A. A happy effort; the foreground extremely bold, and the introduction of the eagle adds much to the general effect.

150. *News-Boy: by H. Inman*, N. A. This picture has great breadth, and portrays the peculiarities of that biped a news-boy with much truth. The accessaries are carefully painted, and tend to illustrate the habits of the boy.

170. *Sea-Coast: by W. M. Oddie*, H. A pleasing picture, and an evident improvement on Mr. O.'s previous works.

179. *Portrait of a Young Lady: by D. Huntington*, N. A. A more than beautiful portrait, executed in all its parts with most consummate skill. Should Mr. Huntington produce many such pictures, he can choose his position in the arts and maintain it.

189. *View of the Falls of Nunda, near Portage, on the Genesee River: by T. Cole*, N. A. After seeing Nos. 110, 124 and 128,

painted by the same artist, we are unwilling to believe that this picture has been exhibited with his consent. It is sketchy, spotty in its effects, and not painted with his usually accuracy in its details.

195. *Portrait of a Gentleman; by E. Mooney*, N. A. An excellent likeness, fully worthy the original, H. Inman, Esq. It is a plain, unostentatious picture, void of claptrap, and is alike simple, forcible and true to nature.

216. *Portrait of the Artist: by T. P. Rossiter*, A. Good disposition of light and shade; something after the manner of Fink.

219. *The Mother and Child: by Washington Allston*, H. We had expected much from this master, which may perhaps account for our disappointment with this picture. Our recollections of his "Spalatro, or the Vision of the Bloody Hand," are still too vivid to expect any other than great works from his hand. The picture before us is a good composition; but the manipulation, particularly in the flesh, would never be recognized as Mr. Allston's production.

218 and 224. *The Billetdoux and Begging the Secret: by H. P. Gray.* In imitation of the style of the old masters, and much better than most of the old pictures denominated choice in the collections of our citizens.

230. *St. John the Baptist: by G. Marsiglia*, N. A. There is much to admire in the finish of some parts of the picture, but the drawing is certainly very faulty.

231. *Julius Cæsar giving the Laws to the Romans: by G. Marsiglia*, N. A. As a whole, it is wanting in tone: each figure, viewed individually or in small groups, is truly beautiful; but when taken together, is flat and insipid. We cannot better describe it than to say that it is a collection of beautiful, small pictures on the same canvas.

238. *Portrait of a Bull: by J. Burford.* Beautifully painted: full of truth and nature.

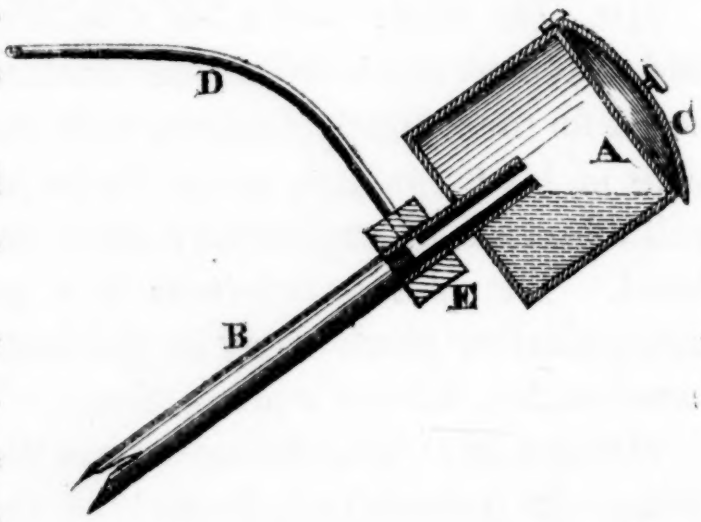
240. *Miniature Portrait of D. E. Tylee, Esq.: by T. S. Cummings*, N. A. An admirable likeness; with great truth, squareness of shadows, and delicacy of touch. The drawing is unexceptionable, and the hands (so difficult in miniature) are absolute portraits.

WHITE LEAD.

This article has of late so increased in consumption as to render every improvement or facility in its manufacture of great value.

Mr. Smith Gardener has successfully and practically introduced a method by which, without the use of acetic acid, he can make white lead direct from the metal as purely white as that formed by the clichy process, and having as much body as white lead made by the old process.

The following description will fully illustrate the plan :—



A—Wooden pan lined with lead, 5 ft. diameter, 12 inches deep.

B—Shaft moved by power, placed at an angle of 45°, making 14 revolutions per minute, being hollow at its upper end, and projecting into A six inches.

C—Cover of A, fitted so loosely as to admit atmospheric air.

D—Tube conveying carbonic acid gas through the loose collar into A, through the hollow part of the shaft B.

Two hundred pounds of granulated lead, and 8 oz. of water, are thrown into the box A, which, by revolving, exposes each particle of lead successively to the action of water, air and carbonic acid gas. The atmospheric air supplies oxygen to convert the surfaces of the particles of lead into protoxide, which, as fast as formed, takes up an atomic proportion of carbonic acid, thus forming carbonate of lead or white lead. After remaining 24 hours, 30 lbs. of the metallic lead are converted into white lead, which remains suspended in the water as a pulpy mass; this in then removed, fresh water added, and a corresponding quantity of lead to that consumed is added.

This process presents some strange phenomena: if protoxide of lead (litharge) be placed in the pan, it will not be converted into white lead; but if a small quantity of the granulated metal

is present, the action becomes rapid and successful, although no more so than when metallic lead alone is used.

Mr. Gardener proposes so to alter his plan as to use an Archimedean screw through which he can force atmospheric air and carbonic acid gas. By this arrangement the surfaces acted upon will be much greater, and the distance traveled over sufficient to convert the lead entirely into white lead before it leaves the upper end of the screw. From the weight of the granulated lead and water being so much nearer the line of motion than with the present plan, a great saving in power will ensue.

The Clarion.—Since the return of the steam-barque Clarion from Havana—for which port, it will be recollected, we noticed in the number for April her departure hence—she has made an experimental trip down the bay, for the purpose of more fully testing the efficiency of the Ericsson propeller.

A number of naval and scientific gentlemen were on board, and arrangements were made for ascertaining the speed of the vessel by bearings in the bay and harbor, as well as by the log, the consumption of fuel per hour, the number of strokes per minute, the state of the tide and wind, and, in short, every particular that might affect the experiment. Capt. Perry, U. S. navy, and Mr. Rhodes, naval constructor, were appointed by Government to examine fully, and report upon the operation of the propellers during the trip, as it is in contemplation by the department at Washington to build a steamer adapted to these propellers, with engines of 700 horse power.

We shall take the earliest opportunity to lay this report before the reader; premising, meanwhile, that the result of the trial, so far as we had an opportunity of hearing, gave general satisfaction to those who witnessed it.

Large Forgings.—It is generally supposed that heavy forgings cannot be executed in this country—that from want of demand our manufacturers are unprepared for such orders. We are happy to state that this is not the fact. The water wheel shafts

for the steam frigate Missouri, forged at the West Point Foundry, are each 25¼ feet long, 19¼ inches diameter at the largest part, and 17 inches at the journal—weighing, finished, 20,184 lbs:—each shaft in its forged state weighed 24,249 lbs. Those of our readers who may wish to see one of these shafts, can do so at the U. S. navy yard, Brooklyn. The shaft was made from the faggot, the bars of iron being 4¾ inches square.

PROGRESS OF SCIENCE.

On the Cause of the Production of Daguerreotype Pictures; in a Letter to the Editors of the Lond. Phil. Mag. and Journal. By MARTYN J. ROBERTS, *Esq.*

Although the daguerreotype process has long excited intense interest in the scientific world, we have not as yet had an explanation of the wonderful effects produced. I believe that even M. Arago has failed to elucidate the theory; and not only has this great philosopher been foiled, but the inventor of the process is unable to solve the problem; with these facts before me, I feel it almost presumptuous in so humble a votary of science as myself to attempt an explanation of the cause of the production of daguerreotype pictures, but if my attempt has the effect of directing attention to the right path for arriving at a solution of the question, I shall be satisfied. We all know that light has a powerful influence on crystalization; solutions that will not crystalize in the dark instantly form on the admission of light; the crop of crystals is always more copious on the enlightened side of a glass containing a crystalizing liquid than on the dark side. Ice forms more rapidly during moonlight, and on the break of day, than on a dark night; but I need not adduce examples of the influence of light on crystalization, for the fact is allowed by all scientific men.

Let us then suppose, that in the daguerreotype process the cleansed silver plate is exposed in the dark to the vapor of iodine; this deposits itself in a flocculent or powdery state on the plate, unable to form the peculiarly shaped iodic crystals, from the absence of light; but yet all other requisites being present, it may be considered in an incipient state of crystalization, or balanced so finely that the admission of the excitant light instantly throws it into plate-formed iodic crystals, but only in those parts where the light has impinged, and here its perfection of, or continuity of crystalization, is merely in proportion to the intensity of light.

Having now the iodated plate removed from the camera obscura, where it has undergone a surface crystalization, more or less perfect in those parts where the lights and shades have fallen, we submit it to the mercurial vapor; the atoms, vesicles, or globules of this vapor being very minute, attach themselves to all the minute inequalities of face in the iodine; on those parts which are fully crystalized the vapor is pre-

cipitated on the flat tabular surface of the crystals, and here offering a continuous and equal angle of reflection to the eye it appears white and resplendent. On the non-crystalized or imperfectly crystalized surface of the iodine, which being in a measure powdery and offering no determinate angle of reflection to the eye, the mercurial vapor adheres, but in no flat surface or continuous determinate angle capable of reflecting a mass of light; it may be said it is here unpolished.

Again, may not the angle under which it is necessary to view a daguerreotype picture be that of the facet of the iodic crystal, and this be a further confirmation of my theory? The mercurial vapor covers the whole of the iodine, and thus protects it from the further action of light.

Such are the crude views I have formed on this subject, and I trust they may lead to a further elucidation.

Coins, Weights and Measures. Proposed change in Weights, Measures and Moneys in Great Britain and the United States. By D. J. Browne, Esq. *Civil Engineer, of New-York.* [From "Hunt's Merchants' Magazine."]

It may not be generally known, that a body of learned men in Great Britain have been engaged for some years in the "commission" of devising a more simple and convenient system of weights, measures and moneys; and as the question is one of deep importance to our own country, it may not be amiss to prepare our readers with a few observations anticipatory to the forthcoming "Report."

In two countries like Great Britain and the United States, which stand first in point of commerce in the known world, it can but be looked upon as a reproach that 27 years of peace should have been suffered to elapse without this great desideratum having been accomplished, except in some trivial particulars; and the more so, as France had, at the earlier date of her republic, proved to us its practicability and advantages. The subject, however, presents so many embarrassments for ingenuity to exercise itself upon, that it is difficult to bring a body of mathematicians to the same conclusion, in consequence of their not being able to agree to start from the same point. Napoleon, in the latter respect, was more favorably circumstanced—for he was not only a clear-headed mathematician himself, and therefore capable of judging of the matter, but when he had come to a conclusion, his power was sufficiently strong to carry out his views without resistance, even if his name had not been enough to recommend them as infallible. In England and this country, on the contrary, no government could pretend to the despotic control, even if it possessed the requisite attainments, necessary to originate and enforce a change. . It is a subject alike out of the sphere of the legislatures and executives, who are, therefore, compelled to devolve its consideration upon some other competent deliberative body; and as to each member of such a body, his own ideas naturally appear the most simple and efficacious, years are consumed in the work of mutual conversion, before they can agree upon the basis whereon their superstructure of practical calculations is to be raised.

There are many who think that any alteration of established weights, measures or coins must be injurious, whatever may be the abstract merit of the proposed innovation; and there are others who doubt the practicability of introducing any changes without a long period of confusion, and the conquest of a large force of resistance. This may be true to a certain extent; but when shall we be better prepared for a change? It can be nothing more than a trivial sacrifice on the part of some of the present generation for the benefit of their successors. One thing, however, should be borne in mind, that is, whatever system of weights and measures Great Britain may choose to devise, it will be highly important for us to adopt, in consequence of the intimate connection of the commerce of the two countries. In this respect it is desirable that the fundamental bases of the weights, measures and coins of all the countries with which we have commercial intercourse should be the same; but this could not be done without producing, for a long period, confusion, injustice and error.

The great desideratum in establishing a new system of weights, measures and coins, is, that the *quantity* and the *money* should be subdivided in the same way, that is, reduced to the same notation; and the best notation for the purpose is, of course, that which is the common base of arithmetic nearly all over the world, namely, the decimal—a scale which, as it ascends from units to tens, hundreds, and thousands, so also descends to tenth, hundredth, thousandth parts, &c. Such a system, both as regards their weights and measures, and their coins, has been successfully carried into practice in France and Netherlands, and as far as the coins are concerned, in the United States. With such a general notation, the keeping of commercial accounts would require nothing but the expeditious process of common addition, subtraction, multiplication, and division. Suppose, for example, that the pound in weight, and the pound or dollar in money, were both subdivided into tenths, hundredths, and thousandth parts, (call them, if you please, *dimes*, *cents*, and *mills*,*) then five pounds, six *dimes*, three *cents*, and four *mills*, in weight, would be expressed by 5.634 lbs., and the value, in money, at two pounds, six *dimes*, eight *cents*, four *mills*, or £2.684 per lb. avoirdupois would be arrived at by merely multiplying the two expressions together, producing £15.122. This example is an extreme one, and is only given for illustration. Indeed, those who are familiar with the facilities of decimal arithmetic, we trust, will not accuse us of exaggeration in saying, that if the weights, measures and moneys of the two countries were brought under that notation, any one moderately expert in simple multiplication and division, might acquire a proficiency in making up accounts, invoices, &c. in a few hours. Under the present system, years are spent in the earlier part of life in learning rules "by heart," which are seldom long remembered; and acquiring a knowledge of formulæ which are still more seldom understood, almost every one being compelled, in after years, to supply himself with what his tutor failed to impress upon his memory, by a sort of mental arithmetic of his own. By substituting the decimal system, this would be entirely done away with. Instead of the tutor wanting an "assistant," the pupil, as

* We learn that some such nomenclature as this will be proposed in the Report.

far as the arithmetic of the shop and the merchant's counting-house is concerned, would have but little need of assistance; and as the groundwork of commercial knowledge would thus require less time and talent, those intended for commercial occupations would be able to devote more ability and greater opportunities to the attainment of a higher order of knowledge that would be useful to them in their pursuits, than under the old regime can be expected from them, until they have acquired it by a long course of actual experience.

Having thus described the advantages of a purely decimal system, we would name three great principles by which, it is hoped, the "commission" has been guided. First, that the old integral bases should be preserved in every case where there are not very strong reasons to the contrary; secondly, that whenever the integral base is altered, it should be mainly with a view of facility in converting values and quantities from the old scales into the new; and thirdly, that the number of scales used should be reduced as much as possible without producing a greater degree of inconvenience than their suppression would remove.

The importance of preserving the old integral bases will be obvious to any man of business, from the following reasons. Almost every commercial house has a multitude of old accounts to which reference is frequently necessary; and as it would be required to translate the particulars of them into the language of the new system, that language should be assimilated as far as possible to the arithmetical language now in use. By preserving the sovereign or pound sterling of Great Britain, for instance, as the integral base for money in that country, no other labor would be imposed on the accountant than converting the heterogeneous fractional parts now in use to their equivalent decimal expression, an operation with which any one may become familiar in a few hours' practice. Then all the new coins of that country of a denomination less than a sovereign would be required to express the tenth, hundredth, and thousandth parts of the pound sterling; and not only can any value under the pound sterling be set forth in those three parts alone, with greater convenience and to a greater degree of nicety than by the nine coins now in circulation for the purpose; but the silver coins as low as sixpence now current may be expressed determinately in them, and would therefore cause little embarrassment should it be found impracticable to withdraw them wholly at once. The crown, for example, would be two dimes and five cents or $\frac{25}{100}$ of a pound; the shilling, five cents or $\frac{5}{100}$ of a pound; the sixpence, two cents and five mills or $\frac{25}{1000}$ of a pound; the penny, four mills or $\frac{4}{1000}$ of a pound; and the farthing, one mill or $\frac{1}{1000}$ of a pound.

With regard to the legal coinage of our own country, it probably could not be improved, with the exception of a slight alteration in the weight of our cents; but when we come to the obtrusive, incongruous and illegitimate eighth and sixteenth dollar pieces of Spain, a sweeping change seems necessary. The change could readily be effected by reducing the value of the $12\frac{1}{2}$ cent pieces to 10 cents, and the $6\frac{1}{4}$ cent pieces to 5 cents, which would soon drive them out of the country, after the manner of the old pistareens a few years since. No individual who has long resided among us can be ignorant of the inconvenience and perplexity he has met with by the use of these coins, and can be so

prejudiced as not to be willing to have them abolished. With these alterations, only a slight change would be required in our laws, such as the reduction of postage from 18¾ cents to 15 cents, 12½ cents to 10 cents, 6¼ cents to 5 cents, &c. which has long been called for, and a few others.

Presuming that the foregoing advantages are sufficiently obvious to create a change in moneys, we shall next endeavor to show wherein the system of weights and measures can be improved, which will be equally applicable to both countries.

1. *Measures of Length.*—The unit of the measures of length, we conceive, should be the present yard of Great Britain and the United States, which all other measures of extension, whether they be lineal, superficial or solid should be derived, computed or ascertained. For scientific, mechanical, mercantile and retail purposes, it should be divided into tenths, hundredths and thousandths, which can be made to express any other fractional part of a yard that would be likely to occur in business. For instance, 2⅛ yards would be written 2.125; 2¼ yards, 2.25; 2⅜ yards, 2.375; 2½ yards, 2.5; 2⅝ yards, 2.625; 2¾ yards, 2.75; 2⅞ yards, 2.875, &c. For itinerary, marine and agrarian purposes, 2 yards would constitute one fathom; 5½ yards, one rod; 22 yards, one chain of 100 links; and 1760 yards, one statute mile; the latter terms, and quantities having long been used in both countries to define distances on maps, charts, deeds, grants, and other important documents, to which reference is often required, and consequently should be preserved. The terms *feet*, *inches* and *lines* should be abolished, their places being supplied by the tenths, hundredths, and thousandths of a yard. All old measures of feet and inches can readily be reduced to yards and the decimals of a yard, by dividing the feet by 3, and the inches by 36.

By the new system, the chief implements to be used in measuring would consist of a rule or line one yard in length, graduated on one side into tenths, hundredths and thousandths, and on the other into eighths, quarters, halves, &c; or of shorter or longer rods or lines graduated into the subdivisions or multiples of a yard; and the Gunter's chain 22 yards or 100 links in length, which has long been used in both countries for agrarian measures.

2. *Measures of Surface.*—The unit of the measures of surface might consist of the square yard, which could also be divided into tenths, hundredths and thousandths, and be made to express any other fractional parts of a yard. 4840 square yards would, as at present, constitute an acre, which could likewise be divided into tenths, hundredths, thousandths, &c. and be made to express any other fractional part of an acre. The terms *rood* and *rod* would very properly be discontinued, which could easily be reduced from the old system to the new, the former being just 0.25 and the latter 0.00625 of an acre.

3. *Cubic or Solid Measure.*—The unit of this measure might very conveniently be made a cubic yard, which could be divided into tenths, hundredths, thousandths, &c. for merchants and engineers, and into tenth-yard, hundredth yard and thousandth yard cubes for other purposes.

Wood and *timber* could be bought or sold by the cubic yard, which

might likewise be divided into tenths, hundredths, thousandths, &c. Then the most convenient lengths to cut market fuel would be 1, $1\frac{1}{2}$ and 2 yards. The term *ton*, as applied to rough and hewn timber, and to shipping in a cubic sense, might be discontinued, and cubic yards substituted in their stead.

4. *Liquid and Dry Measures.*—The unit of liquid and dry measures might very properly consist of the old wine gallon, which contains at present 231 cubic inches. It could be divided into tenths, hundredths and thousandths, &c. which can readily be made to express any other fractional part of a gallon that would occur in practice. The bushel might contain 10 gallons "strict measure," and should not be used for any other purposes than measuring such materials as cannot consistently be bought or sold by weight. It might also be divided into tenths, hundredths, thousandths, &c. which could be made to express eighths, quarters, halves, &c. as exemplified in the measures of length. The old denominations, *quarters*, *weys*, *lasts*, *cooms*, *pecks*, *pottles*, &c. might be discontinued.

The measures necessary to be used would be the bushel; $\frac{50}{100}$ or $\frac{1}{2}$ bushel; $\frac{25}{100}$ or $\frac{1}{4}$ bushel; $\frac{125}{1000}$ or $\frac{1}{8}$ bushel; $\frac{10}{100}$ bushel or gallon; $\frac{50}{100}$ or $\frac{1}{2}$ gallon; $\frac{25}{100}$ or $\frac{1}{4}$ gallon; $\frac{10}{100}$ gallon; $\frac{5}{100}$ gallon; $\frac{4}{100}$ gallon; $\frac{3}{100}$ gallon; $\frac{2}{100}$ gallon; and $\frac{1}{100}$ gallon. $\frac{1}{100}$ of a gallon is equal to $\frac{1}{3}$ of a gill nearly; and in purchasing a half-pint of oil, it would be as easy to ask for 6 cents of a gallon as it is to ask for half a pint.

5. *Measures of Force of Gravity or Weight.*—Properly speaking, there should be no other scale of weight than avoirdupois; and there seems to be no reason for more except ancient usage, which originated when particular branches of commerce were in their infancy. But when we consider that both the old and new coinage of Great Britain and this country have been uniformly estimated by Troy weight, as well as all medical prescriptions or formulæ, under a peculiar subdivision, and that these weights are required to be used only by a very limited number of persons, we shall be very strongly disposed to preserve them.

The unity or integral base of commercial or avoirdupois weight might be denominated a *pound*, and be equal in weight to two pounds of our present weight. It could then be divided into tenths, hundredths, thousandths, &c. which might also be expressive of any other fractional parts of a pound that might occur. Then one hundred weight would be equal to 100 lbs., and one ton would be equal to 1000 lbs., or 2000 lbs. of our present weight. The terms *quarters*, *stone*, *ounces*, *drams*, &c. could then be very conveniently dispensed with. The old system could at once be converted into the new, as the pound of the former would be just half that of the latter; and the other divisions could readily be reduced to the decimal notation.

Under this improved system, the weights that would be requisite for the common purposes of weighing, would consist of 25 pounds, 20 pounds, 10 pounds, 5 pounds, 4 pounds, 3 pounds, 2 pounds, 1 pound, $\frac{50}{100}$ or $\frac{1}{2}$ pound, $\frac{40}{100}$ pound, $\frac{30}{100}$ pound, $\frac{25}{100}$ or $\frac{1}{4}$ pound, $\frac{20}{100}$ pound, $\frac{10}{100}$ pound, $\frac{9}{100}$ pound, $\frac{8}{100}$ pound, $\frac{7}{100}$ pound, $\frac{6}{100}$ pound, $\frac{5}{100}$ pound, $\frac{4}{100}$ pound, $\frac{3}{100}$ pound, $\frac{2}{100}$ pound, and $\frac{1}{100}$ pound. The ten latter weights could very conveniently be substituted by our cents, if they were coined

of the weight of $\frac{1}{100}$ of a pound each.* $\frac{1}{100}$ of a pound would be equal to $\frac{1}{3}$ of an ounce of our present weight nearly; and in making small purchases, it would be as easy to call for 3 cents of a pound of indigo as it would be to call for an ounce.

We now make some remarks upon a subject which grows out of the preceding, though not intimately connected with it, namely, determining the strength of distilled spirits. It is a matter of surprise that the governments of Great Britain and the United States have never devised a more equitable and intelligible mode of testing the degrees of strength of spirituous liquors than the modes in present use. It would be the means of adding immense sums to their revenues, and would enable those engaged in this branch of commerce to regulate their prices in proportion to the values of the articles in which they traffick. There is no reason, either practical or philosophical, why alcohol, when employed as the base for the standard of spirituous liquors, should not be absolute, or totally deprived of water. A definite mixture of alcohol and water is as invariable in its nature, and as invariable in its value, as absolute alcohol, and can be more readily, and with equal accuracy, identified by its specific gravity, the only quality or condition to which recourse can be had for the practical purposes of determining the proportion of standard spirit present. Hence, the intrinsic value of a spirituous liquor is in proportion to the quantity of absolute alcohol it contains; and the more imperfect the instrument for determining this quality, the greater or less will be the benefit or detriment to the dealers in this commodity.

The denominations *first proof*, *second proof*, *fourth proof*, *Holland proof*, 80 *per cent above proof*, 60 *per cent below proof*, &c. are arbitrary terms, used in various countries to express certain degrees of strength of spirituous liquors. Nearly all the instruments invented for this purpose disagree in this respect, and are generally based on absurd and inequitable principles. Hitherto no instrument has been constructed which performs its office with more ease and expedition, and with less error, than the *alcoömetre* of M. Gay-Lussac. It has been used as the standard of France, Sweden, and Prussia, for fifteen years; and, by a slight modification of the tables which accompany it, it might readily be adopted into Great Britain and the United States, from which incalculable advantages might be derived. The scale of this instrument is divided into 100 parts, called degrees, which denote the per centage or hundredth parts of absolute alcohol of a specific gravity of 0.7947 at 15° centigrades, or 59° of Fahrenheit. When the instrument is plunged into distilled water of the above named temperature, the surface of the liquid is cut by 0° on the scale, and when plunged into alcohol of the specific gravity and temperature as above, it stands at 100°. If it be plunged into a mixture of equal volumes of the same kind of alcohol and distilled water at the said temperature, it will stand at 50°, which is regarded as *proof-spirit* or *Holland-proof*. After this principle of graduation, the strength of a spirituous liquor may be known by the number of degrees or hundredths, by measure, of absolute alcohol that the liquor contains at 59° F. If it were desirable to know the true

* In the monetary system of France, the coins, if they are accurately minted, serve also for weights. Thus, 5 francs in copper, 50f. in *billon*, 200f. in standard silver, or 3100f. in standard gold, should weigh one kilogramme or 1000 grammes.

quantity of absolute alcohol that a given quantity of spirits contains, of that temperature, it would only be necessary to plunge the instrument into the liquor, and multiply the number of degrees at which it would stand by the capacity of the cask, and the result would denote the quantity required. Suppose, for example, a cask containing 120 gallons be filled with a spirituous liquor in which the instrument would stand at 55° at 59° F.; 120 multiplied by 0.55 will produce 66, the number of gallons of absolute alcohol present.

The instrument is sometimes accompanied by a book of rules and tables for proving liquors, at various degrees of temperature, by the centigrade thermometer, and likewise for mixing liquors of different degrees of strength, &c. The centigrade thermometer should be employed in preference to that of Fahrenheit, as it is graduated agreeably to our new system. We are happy to learn that the "Regents of the University" have adopted the centigrade at the several colleges and academies in the state of New-York, and it is our ardent wish that its use might become general throughout the world.

The foregoing system could undoubtedly be brought into practice in a very few years, if a law were passed and rigidly carried into effect that would nullify all legal suits other than those contracted agreeably to the new system. Persons who are known to keep in their possession weights and measures different from those provided by law, and to buy or sell by the same, should be prohibited from recovering in any legal suit that might be instituted by them.

We will close by stating a few of the more prominent advantages and disadvantages of a perfectly decimal system of weights, measures, &c. The chief advantages are:

1. All computations would be performed by the same rules as in the arithmetic of whole numbers.

2. The application of logarithms would be materially facilitated, and would become universal, as also that of the sliding rule.

3. The number of good commercial computers would soon become many times greater than at present.

4. All decimal tables, as those of compound interest, &c. would be popular tables, instead of being mathematical mysteries.

5. Uniformity of weights, measures, quantities, &c. would exist between the two countries as well as throughout all the states, which would prevent a great deal of confusion, inconvenience and error.

As the preceding advantages are sufficiently obvious, we will next give the disadvantages that would ensue in consequence of the change.

1. The period of confusion attending the change.

2. The existence of a class of persons who cannot, by any process, master any difficulty of an arithmetical kind.

There is no question in our own minds as to the side on which the scale predominates; but we will leave the question to be settled by the feeling of the large majority, who would reconcile themselves to the change with more or less difficulty. Those who consent to face this difficulty will deserve the thanks of posterity; and we cannot but think that there are few who, looking at the easy manner in which the new system could be introduced, would count their own share of the inconvenience too much to pay for a real and lasting benefit to society.

Method of obtaining Steel of Different Compositions and Qualities.
[From the "Moniteur Industriel."]

In a memoir on the manufacture of cast steel at St. Zlataoust, the imperial manufactory of swords and of iron, situated in the southern part of the Oural mountains, Colonel Anasof describes the processes adopted in that manufactory to produce the steel in earthern crucibles by the fusion of bars of iron and steel by means of blast furnaces. The peculiarity of this process consists in this: that iron is put into the crucibles covered with charcoal to submit it to a kind of cementation, whilst in England steel previously cemented is employed. In other respects there is nothing new in the method adopted, but it may be serviceable to state briefly the means indicated by the author of the memoir, of obtaining steel of different varieties in its composition and qualities. The following are his observations on this point:

"The processes adopted for the fabrication of steel are sufficient to show the principal causes which tend to vary the qualities of this metal; as, for example, the quantity of carbon absorbed by the iron, and the nature of the iron itself. As the first of these causes may be regulated at will, it requires no explanation, and the second need not now be considered. I will therefore confine myself to the rules that I have formed, which are the results of a great number of experiments.

"1. The purer the iron, that is, the more free it is from other substances, the better will be the steel procured from it; but the cementation will require longer time.

"2. All qualities of soft iron are not to be preferred to brittle iron; for if the hardness of the latter be caused by the carbon it contains, it is preferable to soft iron, of the same qualities in other respects.

"3. The aptitude of the iron to be converted into steel depends more on the quality of the iron ores even than on the preparation of the iron. For instance, the iron procured at Zlataoust, from the ore extracted from the Tesminck mine, is preferred to that of all the other mines in that neighborhood; and the iron from the iron works of Tagilsk produces steel of a superior quality to that from Zlataoust.

"4. The steel clippings from the swords made with cemented steel produce cast steel of a quality little superior to that of the clippings of iron.

"5. The bars of iron which have been buried under ground for some time, produce steel of a quality superior to that obtained from iron which has been recently manufactured. This fact was known in Asia in the most ancient times, but Europeans having forgotten the lessons of their masters in metallurgy, have been in arrear of those nations, not only in the art of making the best steel, but also in the knowledge of the signs by which the perfect article can be positively ascertained. If we are well informed, one English cutler at least, Mr. Weiss, has satisfied himself of the superiority for making steel of iron which has remained a long time under water.

"6. The clippings or pieces of iron which have been a long time exposed to the air, produce worse steel than fresh iron.

"7. The steel is of better quality when the pieces of iron are homogeneous and of equal size.

"8. The steel is softer when the opening in the crucible for the proof is small, provided that the pressure of the iron be equal up to the time the lid is put on the crucible.

"9. If the workman have neglected to put the lid on in time, he may render the steel of good quality by adding as much iron as is necessary to raise the metal to the proper height.

"10. If at the time of the final proof the steel does not send forth sparks sufficiently bright, the evil indicated by this bad sign may be remedied by introducing through the opening of the crucible two or three pieces of iron, of the weight of about half a kilogramme.

"11. The fusion of the steel mixed with powdered charcoal or soot in determined proportions, and in a closed crucible, as proposed by Messrs. Mushet and Bréan, might indeed produce steel, but its degree of hardness would be much less certain than on the plan I have described. In fact, if the charcoal be in excess the steel will become too hard; if there be not enough, the metal will be difficult to fuse, because a part of the charcoal will be volatilized.

"12. The addition of other metals, such as platinum, silver, or gold, in the proportions of 1.5 to 1.2 per cent, somewhat improves the quality of the steel; but the more pure the steel is, the less advantageous do such additions become. The effect of the addition of these metals consists principally in making the steel more easily forged, the proportions of carbon and iron being equal.

"As to brittle metals, their mixture with steel is always more or less injurious, and this becomes more apparent in proportion as the quantity of the alloy is increased."

Inexplicable Phenomena of Unannealed Glass. [From the "Liverpool Mercury."]

We have long been accustomed to regard the phenomena which precede and attend the fracture of unannealed glass, as some of the most remarkable and inexplicable of all the manifold secrets of nature. Many other phenomena, although curious, might have been predicated after mature reflection, as they are in strict accordance with the known laws of nature; but we think we may confidently assert, that no man, how skilled soever he might be in chemistry or any other department of natural philosophy, could have predicted the effect produced upon unannealed glass by the most apparently insignificant and inadequate cause. If any philosopher or chemist, for instance, had been asked what would be the consequence of dropping a few grains of light sand into a goblet of glass not properly annealed, he would never have guessed that the effect would be to shiver the tumbler into atoms. As it is possible that some of our readers may not understand what is precisely meant by unannealed glass, it may be proper here briefly to explain the term:

When glass, from the melting pot, is fashioned into tumblers, bottles, &c. it is gradually cooled by being removed successively from a higher

to a lower temperature, which process is termed annealing. When this gradual process is neglected, the most extraordinary results are found to take place. What are called Prince Rupert's drops are an excellent and familiar illustration of the anomalous phenomena under consideration. They are formed simply by dropping a little melted glass into cold water, when it suddenly collapses into a small pear-shaped drop, with a slender thread-like tail or extremity. If the thick end of the drop be held in the hand, and the small end be broken off, the whole of the glass will fly into shivers, imparting to the hand a smart shock, similar to that from an electrical jar. What is equally singular is, that if Rupert's drops, instead of being broken in the manner described, be thrown down forcibly upon flags, they will recoil by their elasticity, but they will not be broken, how violently soever they be brought into contact with the flags.

We have now to notice another of the numerous phenomena exhibited by unannealed glass, which is not so generally known as that of the Rupert's drop, but which is equally inexplicable. It was communicated to us several months ago, by the correspondent whose note we here subjoin, with a few comments appended to it :—

"Sir—Allow me then to detail a curious accident which happened under my own hands, with a glass tube, and which has occurred to several others to whom I have mentioned it. Some short time ago I procured a glass tube for the purpose of constructing a barometer. After cleaning it well with an *iron wire* tipped with wash leather, I placed it upon a table, and was astonished to find in a quarter of an hour the tube broken into several pieces. On mentioning it to a friend, he immediately pronounced it to be caused by the wire, as he had had a similar accident. Not being satisfied that it could be produced by the wire, I placed another tube with a bit of wire in it, and was surprised to find that in a short time the tube broke into several pieces. I cannot account for the phenomena, neither is the fact noticed in any scientific treatises with which I am acquainted. Barometer makers seem to be aware of it, and never use wire in cleaning their tubes."

The phenomenon which is the subject of our correspondent's letter is familiar to the barometer makers, who, in cleaning out the interior of the tubes, take especial care that the iron wire employed for the purpose shall not touch the glass, as the contact of the two substances is almost uniformly followed by a fracture of the glass, not immediately, but after a short interval. This is one of the most extraordinary circumstances of the phenomenon; as it is difficult, if not impossible, to form any rational explanation of the secret mysterious operation which must be going on in the tubes between the moment of contact with the wire and the subsequent fracture. If, as there is reason to conclude, the momentary contact of the wire with the glass produce the fracture, why does it not instantly take place? There appears to be an effect without an adequate or intelligible cause. It seems that this kind of phenomenon is not altogether confined to glass, but occasionally occurs in cast metal, probably from its sudden cooling, or from not having been properly annealed. However that may be, it is a fact that the metal of which the mirrors of reflecting telescopes are constructed is very apt to fly to pieces by the slightest scratch, just like the barometer tubes in consequence of their coming in contact with the iron rod used to clean out the inside.

In conclusion we may observe, that the phenomenon of the barometer tubes, noticed by our correspondent, is to be ascribed, no doubt, to their

imperfect annealing, and that the remedy for the defect would be that pointed out by Mr. Pellatt, of London, at a late scientific meeting, from the report of which we transcribe the following passage:—

"Mr. Pellatt recommended boiling as a safe and good mode of annealing all kinds of glass. In the ordinary method of annealing, thick and thin ware is often subjected to the same process, and remains in the *leer* for the same period: this would account for the superior duration of the thin tubes. He attributed the fracture of the tubes to the tension of the exterior coating, and the vibration caused by the process of cleaning: this effect was so well known that an old tube could scarcely be sold, as it generally broke in cleaning."

MISCELLANEOUS.

FOREIGN.

A New Reflecting Microscope.—Mr. Guthrie modifies Amici's Microscope, by removing altogether the plane speculum, and placing the object to be viewed in the axis of the tube. This arrangement is to the microscope what Sir W. Herschel's is to the reflecting telescope. In order that the object may be properly illuminated, the part of the tube next the mirror is wholly removed, and three pillars substituted for it, to one of which the stage for the object is attached, and regulated by an adjusting screw. Jameson's Journal.

Protective Harness Saddle.—A patent has recently been granted for a new kind of harness saddle, for the protection of horses from rain and cold. This saddle contains within it a water-proof cover, which can be drawn out at pleasure, and is so arranged that the driver, while on the box, can either draw it out or cause it to disappear within the saddle. This is effected without the aid of a spring, therefore the mechanism is not liable to get out of order. The covering, when drawn out, entirely protects the animals from wet, and would also prevent them from taking cold when standing, after having been driven. The saddle itself, with the covering inclosed, is not much more bulky than a common harness saddle, and combines an appearance of elegance with great utility.

Ruins of Palatay.—At a late meeting of the Geographical Society, an interesting paper was read, communicated by Lord J. Russell, containing an itinerary of a journey of Lieut. Caddy and Mr. Watson, from Belize to the celebrated ruins of Palatay, in the province of Yucatan, in Guatemala. Notwithstanding their grandeur and immense extent, they were not known to travelers until the latter part of the last century, when it required the aid of 100 Indians to cut down the trees by which they were surrounded, so profuse was the vegetation. The remains are evidently of Egypto-Indian architecture, and in them was seen the true Saracenic arch, which has not hitherto been met with out of the country of the Saracens. The travelers were 48 days in the ruins, making sketches, and returned to Belize through a country rich in every

variety of natural produce, and with which an extensive and advantageous commerce with this country might be carried on. Inventors' Ad.

Voracity of a Boa Constrictor.—A singular instance of the voracity and power of appetite of this reptile occurred a few days since at the Zoological Gardens in the Regent's Park. Two fine tiger boa constrictors were brought over by Captain Redman from Calcutta, and presented by him to the menagerie on 4th September last. They were respectively 11 feet and 9 feet in length, and had lived in harmony together in their cage until last week, when the smaller one, being sickly, would not eat at the usual time of feeding. The larger one had just eaten a rabbit and three Guinea pigs, when it appears he made a gorge of his more weakly companion, which was proved by the sudden disappearance of the latter, and the more bulky size of the former, which exceeded three feet in diameter in the greatest proportion of his body. So singular a case of the carnivorous power and propensity of this reptile is not on record. Morning Chronicle.

Mock Suns.—On Saturday morning se'nnight, about half past 8 o'clock, a very beautiful halo appeared surrounding the sun; and at each extremity of the circle, to the right and left, appeared a mock sun. That on the western side of the halo appeared brilliant, and the sun's image distinct and well defined; but the other, on the eastern side, though equally brilliant at the centre, was rather defective in the general contour. This rare phenomenon continued its exhibition for the greatest part of an hour: the air was cool, and the sky rather obscured, with a little haze, and light fleecy clouds. Halifax paper.

Coal-Tar and Lime as Manure.—Mr. Webster, of Ipswich, recommends the employment of coal-tar and slacked lime as manure. The following are the proportions: Take one gallon of coal-tar, and mix it up well and completely with one bushel of slacked lime: this mixture produces a material of warmth and value as a manure, rich and stimulating, and tending very much to keep away flies when sprinkled freely in among young turnips. He also recommends the use of animal tar, or dippel oil, procured from the distillation of bones, which when mixed with slacked lime as above, forms a much richer and more serviceable manure than that of the coal-tar. Trans. Soc. Arts.

The Perpetual Rose.—A Parisian florist has succeeded in producing a new hybrid rose from the Bourbon rose and Glorie de Rosomene, the flowers of which he had fertilized with the pollen of some damask and hybrid China roses. The plant is extremely beautiful, the color bright crimson shaded with Maroon purple, and is further enriched with a powerful fragrance.

Electrotype Seals.—Among other uses to which the art of electrotyping has been applied, is that of making desk seals from impressions of other seals in wax. This seems to render further precaution against forgery and fraud necessary, as it is now easy to obtain the fac simile of a seal to be used for fraudulent purposes.

Steam-Boiler Explosions.—On Tuesday evening, at the usual weekly meeting of the Institution of Civil Engineers, among other papers there was read an abstract of a paper by Dr. Schafatul, which the author, who was present, illustrated by a small apparatus he had with him, to show that the bottom of the boiler was blown away before the top, in case of an explosion, or rather that the explosive force reached the lower part before the upper, and that therefore "the present safety-valve was in many cases little better than useless." Mr. Josiah Parkes made many remarks on the doctor's experiments, and generally on the causes of the bursting or explosion of boilers. He gave several extraordinary instances of the different effects of explosions, and argued that there must be different causes to produce those various effects. In some cases the accident resulted from there being no water, or only very little, in the boiler; in others, because there was too much: in some, because the existing safety-valve was closed; in others, because it was suddenly opened; and in some cases because there was neither water nor steam in the boiler, nor fire below it. He gave examples, and where the consequences had too often been the sacrifice of lives to a very great extent, as well as the destruction of property. After adverting to the accident on the Norwich river in 1817, which he observed appeared to be one of those events that formed part of the "stock in trade" of every writer on steam-boiler explosions, he adverted to one at Stockport, which occurred when there was neither fire, water nor steam present. In that instance the stoker had, on the Saturday evening, emptied the boiler of its water by knocking up a plug in the bottom, and thereby extinguishing the fire at the same time. The stoker then left the place without having taken off the plate from the top of the man hole. On the Sunday afternoon, about 5 o'clock, the unfortunate man went to clean out the boiler. He took the cover from the man hole, placed a lantern he had on the top of the boiler, and descended into it by means of the iron ladder. When he was nearly down, he took the light, and brought it into the boiler, and that instant he was sent up about 100 yards into the air, and fell through the roof of the dye-house. The boiler rose many feet, and fell back into its seat. The man was scorched as black as a negro. The engineer who entered the yard about the time to see that the stoker was at his work, heard him in the dye-house exclaiming, "Let me out; let me out. I am *frozen* to death!" He broke open the door, and the poor fellow ran past him into his own house on the premises, and died that night, after minutely detailing how the accident had occurred. Then (inquired Mr. Parkes) what was the cause of the explosion? It could not have been in the boiler, for if it were the force would have acted on all sides of it equally. Then where was it? He continued, that for many years he had diligently collected the facts attending every explosion he heard of, and was preparing to put them in such a form as to afford facilities for examination; but in the meantime he thought it advisable to direct the attention of practical men to the facts, that they might arrive at the causes of those explosions, and the manner in which the force acted. He afterwards spoke of an immense number of explosions, adding, that in iron works it was known that a single drop of water would produce tremendous explosive power in this manner: if in a puddle-furnace a drop of water were placed on

the red-hot slag, no effect is produced; but if the drop be pressed into the metal with a stick, then it explodes with force sufficient not only to shatter the furnace, but to blow away the roof of the building. The drop of water could not produce steam sufficient to fill the furnace, so that Mr. Parkes supposed the instantaneous generation of steam from even that small quantity of water produced a wave in the air, which was projected with such force as to destroy everything before it. Times

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Melville Safety-Lamp.—This lamp is intended as a signal for distinguishing steam vessels from sailing vessels at sea. Mr. Melville's plan is to place in front of the funnel of the steamer a lamp, with a clear light, and a strong reflector having an external sliding cover attached to its face, so fitted as completely to obscure the light within, but to be made to move up and down the whole length of the lantern by means of a rod affixed to a small lever power connected with the engine, so that the motion or alternations of the slider would be at the rate of 20 in a minute. At the bottom is to be added a flat sole, made so as to carry the rays of light completely over the side of the vessel, in order that the reflection from any object on deck may not interfere with the sight of the pilot. By means of this simple apparatus, a signal will be produced perfectly distinct from any other known in navigation, and by means of it a steamer will at first sight be known from any other vessel. The working of this new invention has been seen by experienced and intelligent steamboat captains, besides many scientific gentlemen, all of whom expressed themselves highly gratified with the experiment, and fully convinced of its success. Glasgow Argus.

Improved Plan of Chiseling Marble or Free Stone.—A method of cutting letters in marble or free stone has been invented by Mr. Page, an American statuary, now in this country, which prevents the edges of the stone from chipping. This is effected by coating the surface with cement, which adheres to the stone or marble, and the chisel can then cut through as sharply and evenly as into a metal plate. When the letters are cut, they may be blackened by smearing the whole surface with the black varnish. The cement is then readily scraped off, and the engraving is left without blemish, the edges of the stone being perfectly sharp and free from the chipping which the usual method of chiseling produces. Inventors' Ad.

Duration of Literary Copyright in different Countries.—In Prussia, the exclusive right of publication is guarantyed to authors during their lives, and to their heirs for 30 years afterwards. This refers only to literary works. In works of art, plays, or music, the duration of copyright extends only to 10 years after the author's death.

In the Germanic Confederation, literary productions of all kinds, even works of art, are protected for 10 years; but this period may be extended to 20 in favor of large works requiring much labor and expense. The Germanic Confederation intend, however, to take the subject into deliberation next year, with a view to extend the minimum duration of copyright in literary works.

In Russia, any author or translator of a book has the exclusive pro-

perty in the work during his life, and his heirs or assigns for 25 years subsequent to his decease.

In Belgium, the right is conceded to the author during his life, and to his widow and his heirs during their lives; but all right terminates after the death of the first generation of the author's heirs.

In the Pontifical States, by an edict dated in 1826, authors and artists have the exclusive right to publish their works during their lives, and their heirs for 12 years after their death.

In the United States, by an act of Congress dated in 1831, the copyright, which previously only lasted for 14 years, was extended to 28 years, with the right to further extension for 14 years if the author should survive the first term.

In England, by the act of 1814, the copyright in literary works was extended to 28 years, to the author and his assigns; and if at the end of that time the author survive, the copyright is extended for the rest of his life. Inventors' Ad.

New Furnace for Steam-Engine Boilers.—We have this week seen a new plan of setting steam boilers, invented by Mr. Apsey, engineer, which promises to be the means of saving a large quantity of fuel, by exposing a much larger heating surface than can be effected by the usual arrangement of steam-boiler furnaces. It is now the practice to confine the action of the heat to that part of the boiler below the water line, to prevent the boiler from being burnt by the fire on those parts where there is only steam, as would certainly be the case if the flame were allowed to touch it. Either the boiler is bricked over in the upper part, or it is covered with felt to keep in the heat, as no attempt is made to render the upper portion of the boiler part of the heating surface. Mr. Apsey's method combines the advantages of gaining an increased heating surface without incurring the danger of burning the metal. The plan he proceeds on is this:—He makes the boiler rest lengthways on a ridge of brickwork, and he builds up the furnace with a space between the bricks and the boiler to the top, where another ridge of brickwork runs along. The fire is placed at the end of one of these divisions formed under the boiler, and the chimney for the draught is at the end of the other division. The flame thus runs the length of one half the boiler, and passes down the other half to the chimney. In order, however, to prevent the flame from touching the upper portion of the boiler, which would otherwise be exposed to it, the farthest end of the furnace is bricked up below the water line. It is in this contrivance that the chief merit of Mr. Apsey's invention consists; for as the draught at the two ends is confined below the water line, the flame will not rise higher than that point during its draught along the flue. The upper part is thus filled with heated air, which keeps up the temperature of the steam without injuring the boiler. Against this advantage is the set-off that no fire acts on the centre of the boiler; but this may be remedied by substituting an iron partition for a brick one. The saving of fuel by this plan has been tested in several boilers to which it has been applied; amounting, it is estimated, to 25 per cent. Mr. Apsey has a high pressure steam-engine of 12-horse power working the machinery in his factory in Roupel-street, Waterloo-road, which has been performing on

his principle most satisfactorily for some months. The boiler in this instance is only 2¼ feet diameter, and 30 feet long; but the plan is applicable to boilers of all dimensions. Inventors' Ad.

Length of Days.—At Berlin and London, the longest day has 16½ hours. At Stockholm and Upsal, the longest has 18½ hours, and the shortest 5½. At Hamburgh, Dantzic and Stettin, the longest day has 17 hours and the shortest 7. At St. Petersburgh and Tobolsk, the longest has 19, and the shortest 5 hours. At Torneo, in Finland, the longest day has 21½ hours, and the shortest 2½. At Wardorbus, in Norway, the day lasts from the 21st of May to the 22d of July, without interruption; and in Spitzbergen the longest lasts 3½ months. Ib.

Longevity of the Eel.—At the close of the last century, an eel from 3 to 4 inches long was taken from the river Cart, and put into a small well at Gockstone. From that time to the present it enjoyed itself, and seemed to thrive, though in this circumscribed habitation, till a few days ago it was noticed less lively than usual, and in a day or two after it was found lifeless at the bottom. When taken out it was about a yard in length, and in thickness about that of a man's wrist. After being thus known upwards of forty years, it appears to have died purely from old age, being found quite gray on the back and head. The only remarkable incident in its history was, that on a young eel being put in the well a few years back, this aged possessor of the limpid pool showed so little relish for company, or its new associate, that it soon destroyed the stranger. Ib.

Advantage of planting Fruit Trees on Declivities.—Dodart first observed that trees pushed their branches in a direction parallel to the surface of the earth. If a tree stands on a steep, it pushes both towards the hill and towards the declivity; but on both sides it still preserves its branches parallel to the surface. As there is an attraction between the upper surface of leaves and light, I am also persuaded, though not equally certain of it from experiment, that there is an attraction of the same nature between the under surface of leaves and the surface of the earth. This I consider the true cause of the phenomenon. I had long observed that the most fruitful orchards and most fertile trees are those planted on a declivity, and the steeper it is, though not quite a precipice, the more fertile they prove. It is well known that the spreading of trees always renders them fruitful. On a plain they incline to shoot upwards; and therefore art is employed by skilful gardeners, and applied in various ways, to check their perpendicular and to promote their lateral growth. But this point is obtained on a declivity by nature. There a tree loses its tendency to shoot upwards, and in order to preserve its branches parallel with the surface, is constrained to put them in a lateral direction. Hence an important rule in the choice of orchards and fruit gardens. Rev. D. J. Walker.

The Oldest Bridge in England.—The oldest bridge now existing in England is the triangular bridge at Croyland, in Lincolnshire (sometimes called Crowland) which is said to have been erected about A. D.

860. It is formed by three semi-arches, whose bases stand in the circumference of a circle, equi-distant from each other, and uniting at the top. Nicholson says that this curious triune formation has led many persons to imagine that the architect intended to suggest an idea of the Trinity thereby. Inventors' Ad.

To Wash Iron or Steel with Copper.—Dissolve sulphate of copper in water, in the proportion of 1 to 3; wash iron or steel with it, and it will instantly be covered with reduced copper. This is best performed by applying the solution with a brush, which must be followed directly with a sponge of clear water. In this manner any letters or figures may be drawn with a camel-hair pencil or a pen, and if it be on polished steel, the letters or flowers will assume the brilliancy of the steel, and appear like highly polished copper. It may sometimes be requisite to cleanse the metal by washing it with diluted muriatic acid, that the copper may adhere the more readily. If the steel thus ornamented be held over a charcoal fire, the copper figures become blue first; and when the steel becomes blue, the copper takes a gold color, but is restored again to its original color by diluted muriatic acid.

To give Iron the Whiteness of Silver.—To nitric acid, diluted with an equal quantity of water, add as much mercury as the acid will dissolve; then add to the solution three or four times as much water, and having given the iron a coat of copper, as directed in the above experiment, brush it over in the same manner with the diluted nitrate of mercury; its appearance will be equal, if not superior to that of real silver. In this manner any common or rough iron work may be apparently silvered at a most insignificant expense. Ib.

Double Offset Plotting Scale.—The silver medal was presented by the Society of Arts to Mr. James G. Austin, for his offset plotting scale, for the use of civil engineers and surveyors. It consists of two perfectly parallel graduated scales, whose distance is equal to the length of the offset scale, which runs on rollers between them. The parallel scales and the offset scales are graduated to suit the views of the user. The pieces connecting the ends of the double scale are hollowed out to receive the weights, armed with points to enter the paper, which hold the instrument in its place, and prevent its being shifted while in use; and from the centre of each of these connecting pieces projects an index; the points of these indices, and the zero of the offset scale, being always in the same straight line, which is of course the line from which the offsets are to be measured. Trans. Soc. Arts.

Improvement in Locks, Latches, and other Door Fastenings.—This invention consists in the substitution for the springs generally used, of weights or weighted levers, in order to keep the bolts of the lock in a proper position when shot or unshot.

In the lock only one tumbler is used, (though more tumblers or none may be used, according as the lock is required to be more or less secure.) The tumbler turns on an axis behind the key-hole of the lock, and on this axis one end of a weight or weighted lever also turns, the other end extending towards the front of the lock, having a stud on its upper

part and one on its centre. The lock-bolt has two notches cut in its upper part, one considerably longer than the other, being divided from each other by a small projection; there are likewise two openings in the centre part of the bolt, communicating with each other by a slot; into the top notches the upper stud enters, and into the centre openings the lower stud enters, the two studs being in the notches and openings nearest the front of the lock-bolt, when the lock is in a quiescent state.

On the key being turned half-way round, it raises the tumbler, and likewise the weighted lever with its studs, the lower one of which is thus brought opposite to the slot that communicates between the two openings; and the upper one is raised out of the notch it was in, and stands just above the small projection that divides the two notches. The key is now turned round the remainder of the distance, by which means the bolt will be shot, and the tumbler and weighted lever will descend. The upper stud of the lever having passed over the small projection and entered the larger notch, and the lower stud having passed through the slot into the other opening, they will both tend to keep the bolt in its position, till it is again acted on by the key.

The latch-bolt is fastened to the lighter end of a weighted lever, which is suspended from a suitable axis at the upper part of the lock, the heavy end extending towards the back of the lock; the handle of the lock is provided with two small levers, which on turning the handle raise the heavy end of the lever, and so draw back the lighter end and the latch-bolt which is attached to it. Inventors' Ad.

Cast-iron Manufactures.—The following report relative to an improved mode of manufacturing cast-iron articles, by M. Bourbon Leblanc, of Paris, has been made to the Society of Encouragement, by a committee appointed for that purpose:

"The committee of chemical arts having been commissioned to examine the productions in refined cast iron presented to the Society by M. Bourbon Leblanc, make the following report of the result of their trials:—

"Since Reaumur made known the fact that cast-iron when annealed with certain substances undergoes remarkable changes, and acquires properties which assimilated it to soft iron, and render it capable of being substituted for that metal for many purposes, numerous attempts have been made to apply this fact to the arts. The Society has rewarded the exertions of Barndelle, and in England large establishments have been formed for carrying on processes which more or less resemble it. In France, also, exertions have been made to realize the results obtained by Reaumur; but the modes of operating have varied; instead of merely annealing the pieces of cast iron, it has been, when in a state of fusion, mixed with substances intended to reduce it to a homogeneous state, and to give it qualities which render it more like soft iron.

"It is this kind of process that M. Bourbon Leblanc adopts to obtain the articles which he manufactures. The committee, without being acquainted with the nature of the substances which he mixes with the cast iron, in order to give it the requisite qualities, has been present during the operation, and proved that the nature of the metal becomes modified in proportion to the number of refinings to which it is subjected.

The operation may be either effected in crucibles, or in ordinary furnaces. The cast-iron obtained by this means is easily moulded, takes a beautiful polish, has sharp edges, and possesses so much tenacity that different instruments, such as hatchets, chisels, hammers, and other implements, which have been used without any particular care, have resisted all the trials to which they have been subjected.

" The establishments founded either in England or France for manufacturing a variety of articles with refined cast-iron, after having been attended with more or less success, have all of them gradually ceased their operations, because it is considered a sufficient reason for depreciating all such productions, if some articles have occasionally a flaw which causes them to break easily; on the other hand it must be admitted that the very variable nature of cast-iron cannot fail to influence the productions of a manufactory in a very considerable degree; but we may be allowed to say, that cast iron of very inferior quality, subjected to the treatment adopted by M. Bourbon Leblanc, appears to us to have acquired a degree of homogeneity which prognosticate regular results.

" The committee have no data relative to the price of the manufactures of M. Bourbon Leblanc. According to the statements that have been made by the inventor, the expense of refining would be considerably below the price of the materials, even when the operation requires many times repeating.

" If these results are correct, the proof of which can only be decided when the manufacture is worked on a large scale, if the productions are always the same, the process of M. Bourbon Leblanc may be of essential service to the iron manufactures." Inventors' Ad.

Improvements in the Steam-Engine.—Certain improvements in the construction of steam-engines have lately been patented by Mr. Henry Curzon of Kidderminster, adapted more particularly to facilitate the working of steam expansively. The disadvantage which in many cases attends the working of steam expansively is, that the motion is not uniform. To remedy this inconvenience, Mr. Curzon combines three or more steam cylinders to the working of one common shaft, so that in each cylinder the steam may be used expansively through the greater part of the stroke, and the full pressure of the steam in one or other of the cylinders is constantly exerted on the crank shaft. The following is the patentee's description of the action of the engine when three cylinders are employed:—" If the steam-engine is to consist of three steam cylinders, then they being each connected by ordinary well-known means to the shaft or axis to which they are jointly to communicate motion, and in such manner that one piston precedes the next by a distance equal to one-third of the length of the stroke, the cylinders being all of the same diameter and length of stroke, and the slides or valves of each cylinder are to be so arranged as to cut off the steam at one-third of the stroke, as is well understood; hence, by this arrangement the steam in each cylinder will be worked expansively two-thirds of the stroke, and owing to the mode of combining the three cylinders, there will at all times be one or other of the pistons working by the pressure of the steam through the first third of the length of the cylinder; ano-

ther cylinder will be working with the steam expanding through the second third of the length of stroke; and another cylinder will be working with the steam expanding through the third of the length of stroke; and it will readily be seen that, supposing the pressure on the whole area of the pistons to be taken at different points of the rotation of the shaft or axis to which the three steam cylinders are communicating motion, much greater uniformity of power will be found to prevail at all points of motion than could heretofore be obtained when working steam expansively." Though the patentee considers it advisable, if great uniformity of motion be required, that as many cylinders should be employed as the spaces into which the original quantity of steam is allowed to expand, yet the uniformity of motion would not be prejudicially altered, when four cylinders are employed, were the steam to be cut off at one-sixth of the stroke, or even less. He prefers steam at a pressure of 45 lbs. to the square inch. Inventors' Ad.

Striking from Leaves.—In the spring of 1838, previously to his leaving Downton, it occurred to Mr. Knight's inventive mind, that plants might be propagated from single buds and leaves only. Accordingly, he had several pots filled with a fine sandy loam; *the pots were about twelve inches in diameter*, to receive the cuttings, which he prepared himself. The buds and leaves were cut out, as is usually done when intended for insertion in stocks, with but a very small portion of the alburnum to each. The kinds he operated on were double Camellias, Magnolias, Metrosideros, Acacias, Neriums, Rhododendrons, and many others. The soil in the pots having been previously pressed firmly down, and the surface made perfectly smooth, the cuttings were inserted with a dibber, so as just to cover the bud, when the soil was pressed firmly against it. The back of the leaf lying on the surface of the mould was fed by absorbing moisture from it. The surface of the pots was quite covered with leaves, but so disposed that they did not overlap each other; they were then gently sprinkled with water, covered with bell-glasses, and placed on the flue of a forcing-house. The sprinkling was afterwards frequently repeated, and the glasses shaded from the sun, by hanging paper over them. In a short time the buds were seen breaking the surface of the mould, and by the end of summer some of them had made shoots of six and eight inches long, especially the Camellias, which were then potted off. The others that had not made equal progress remained as they were until the following spring, when they likewise were potted, and found to be firmly rooted. Since that time I have tried other sorts with equal success, but perhaps plants that have large leaves are best adapted for this mode of culture. Gar. Ch.

A Chinese Map of the World.—A tolerable idea of the state of Chinese geography may be gathered from a glance at a map of the world produced by them. It is 2 feet wide by 3½ high, and is almost covered with China! In the left-hand corner, at the top, is a sea three inches square, in which are delineated, as islands, and of very small size, Europe, England, France, Holland, Portugal, and Africa! Holland is as large as all the rest, and Africa is not so big as the top of one's little finger. The northern frontier is Russia, very large.

Railway Train Controler.—A private exhibition of a model of Mr. Hancock's ingenious contrivance, for enabling persons on a line of railway to stop a train in case of danger, took place on Saturday, at the Zinc Works in Parliament-street. This invention, which is very properly called a "railway train controler," affords an instance of the advances made in bringing those apparently uncontrolable moving masses under the guidance of man. By this apparatus a child on the railroad might be able to stop the swiftest and heaviest train. The principle on which the contrivance depends has been partly applied for other purposes in railway locomotives; it consists in connecting a part of the machinery with a vertical arm or shaft, to which a projecting rod placed at a small distance from the rails is attached. This rod is to be acted on by a projection on the rail, so that when the engine arrives at that point, the projecting arms strike against each other, and thus move the shaft attached to the machinery of the engine. In Mr. Hancock's patent apparatus three important effects are produced by this single action; the steam is turned off, the breaks are put down, and the steam-whistle is sounded. It is proposed that at numerous points on the line the apparatus shall be fixed to the roadway for acting against the projecting lever, so that the policemen can at any time stop a train if they are aware of danger ahead. The additional apparatus to the engine is so contrived that it does not interfere with the ordinary working of the machinery. Inventors' Ad.

A Safety Kite at Sea.—The wind being south, with strong breezes, a trial was made last week at Sandgate, of the Mariner's Safety Kite, by W. Walker, (of the mounted revenue guard) before Lt. Batt, R. N., and several experienced nautical men, and found to answer in every respect the purpose for which it is designed. It may be as well to add that a wreck having taken place on the 13th of November last, at Dungeness, when two lives were lost in consequence of the high sea preventing any communication from or to the shore, the idea of a kite on board the wreck, so as to be lowered at will when over the land, first struck Mr. Walker as the most feasible and certain method of rescue. This has been accomplished in such a simple manner that a child might manage it with precision, rising and falling within three feet of the earth, again rising without assistance, carrying out 100 fathoms of line if necessary. Communication in the instance of shipwreck at Dungeness would have been the means of saving the crew, had a "kite" been on board. Even uninhabited shores might be reached by an ordinary swimmer attaching the line under his arms. A light is attached to the tail, which neither wind nor rain will extinguish, to be used at night, so that persons on shore may see the kite's position.

Discovery in Animal Chemistry.—The principles fibrin and albumen, which play so important a part in the constitution of the animal solids, are now, on the authority of Liebeg, stated to be identical. M. Denis has communicated a letter to the Academy of Sciences, in which Liebeg states that he has been able to dissolve fibrin by a moderate heat in a saturated solution of nitre, and that the fluid has all the properties of the solution of albumen. Med. and Surg. Jour.

DESCRIPTION OF AMERICAN PATENTS

Granted from March 3d to April 2d, 1841.

Improvements in the mode of rendering Fabrics Water-Proof. By GEORGE JOHN NEWBURY, citizen of U. S., now in London, England. March 3d. [Date of English patent, May 12th, 1840.]

CLAIM.—I therefore claim as improved modes, methods, processes or modifications above described, of applying substances to such saturated textures, so as to prevent one surface therefrom from drying, hardening or forming a pellicle thereon, while the other is allowed so to do by the action of the atmosphere or artificial heat to which it is exposed, evaporating a portion of the aqueous or volatile parts of the oils or compositions, and then afterwards clearing away the moist parts by the agency of spirits of turpentine or other suitable liquid; and also, I claim the mode, manner or process of producing damask patterns or designs on the surface of such fabrics, in the way or manner above stated.

Improvement in Refrigerators. By JOB S. GOLD, Philadelphia, Pa. March 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is not any exact proportions or particular form; but I claim,

1. The *separate apartment for the ice* at the *top* or in the *upper* part of the refrigerator, substantially as above described.

2. I claim the *combination* of the *ice-water* reservoir, and the *arrangement of the shelves*, with the apartment for ice, as specified, for the purpose of producing the circulation of air to equalize the temperature, substantially as above described.

3. I also claim the *ice-water reservoir*, in combination with the apartment for ice, as described.

Improvement in the manufacture of Starch. By ORLANDO JONES, City Road, England. March 12th. [Date of English Patent April 30th, 1840.]

CLAIM.—What I claim as my invention, is, first, the mode of treating or operating on farinaceous matters to obtain starch and other products, especially flour or powder produced from rice, and in the manufacture of starch, by submitting farinaceous matters to a process or processes of caustic alkaline treatment, as herein described; and secondly, I claim the mode of manufacturing starch from rice by the process or processes herein described.

Improvement in Seed Planters. By MOSES PENNOCK and SAMUEL PENNOCK, East Marlborough, Pa. March 12th.

CLAIM.—What we claim as our invention, and which we desire to secure by letters patent, consists,

1. In the arrangement of the spur wheels for the purpose of connecting the seed roller Y and hopper P to the shaft O, as before described.

2. The combination of the rectangular staple $i\,2$, the beam I, the slider S^2, the compound lever L M N, and the hopper frame V W, for

the purpose of throwing the hoppers in and out of operation when sowing point and other land without stopping the horse, as well as for planting seeds that require cultivation in rows, and also for raising the drill V above, or allowing it to sink into the ground a sufficient distance, in the manner above described, or in any other substantially the same.

Improvement in Saw Mills. By DAVID PHILIPS, Georgetown, Pa. March 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the method of attaching the plates or arms to the main flanch, by letting them into recesses, of the form above described, in the flanch, and having a second flanch or plate riveted or bolted to the main flanch, embracing the plates or arms—the plates or arms being provided with long slots, through which the rivets or bolts pass, and a key passing through the flanch and plate, and through a notch in the end of the arms, for the purpose of regulating the sweep of the teeth in their revolution, as herein described. I also claim the guide attached to each plate or arm in front of each tooth, for the purpose and manner described; also, the method of fastening the teeth to the arms by means of the dovetailed wedge lap, as above described. And finally, I claim the method of giving motion to the saw or saws by means of the combination of the screw, the rack or racks attached to the carriage, and the pinion or pinions attached to the saw shaft, so that the motion of the carriage received from the screw shall give motion to the saw or saws, as herein described.

Improvement in Agricultural Instruments, consisting of a Plough combined with a Cultivator and Planter, for Ploughing, &c. at one operation. By WILLIAM H. RIDER, of Belleville, Ill. assignee of JUSTUS RIDER, of Woodburn, Ill. March 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the combination of a cultivator or of ploughs for the preparing of the soil to receive the seed, consisting of an opening shown with two coverers behind it with a seed drill, having an apron in front, with two coverers behind, the seed being deposited at the back of the opener—the arrangement of the shares constituting the cultivator preceding those of the seed drill, as set forth.

Improvement in Horizontal Windmills, &c. By JOHN M. VAN OSDEL, Chicago, Ill. March 12th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the giving of a rotary motion to the two sails *m m*, Fig. 1, as herein set forth, that is to say, by means of the cast-iron cogged rim *b*, (around the vertical shaft of the mill) and the beveled pinion *g g*, Fig. 3, combined with and moving by the pinion at *f f*, (on the ends of the iron shafts *g f*) the toothed wheel 1 and 5 on Figs. 2 and 5, by which the aforesaid sails are made to revolve.

2. In combining with the above driving wheels 1 and 5, on Figs. 2 and 3, the cogged wooden rim *h h*, and the sails *n* Fig. 1, any number of

which may be arranged on the wind wheel; the whole being constructed and operating, combined substantially as set forth.

3. I claim in combination with the above mode of operating the sails *m m*, and communicating motion from them to the other sails, as set forth in the two foregoing combinations, the method of changing the positions of the directions of the wind by means of the vane *b*, Fig. 1; all as herein set forth.

4. I claim the mode of reefing and unreefing the sails, as herein set forth, by constructing the slats composing the sails, with cams (*mm*, &c. Fig. 6) and combining them in the manner described with the slide *e f*, Fig. 6; the pinions *o p*, Fig. 3, and the movable rack A; the whole being operated through the arrangement of levers and rods specified by the governor balls.

Improvements in the manner of constructing and propelling Steam Vessels. By BENJAMIN HARRIS, of Norfolk, Va. and WILLIAM W. HUNTER, U. S. Navy. March 12th. [Antedated Nov. 2, 1840.]

CLAIM.—What we claim as our invention, and desire to secure by letters patent, is the application of shield decks, to vessels constructed of metal or wood, whether propelled by steam power or any other, and also the application of submerged water wheels, on the plan described in the accompanying specification, whether placed horizontally or obliquely, for the purpose of propelling vessels.

Improvement in the manner of constructing Moulds for Casting Butt Hinges. By THOMAS SHEPHERD and THOMAS LORING, Southwark, Pa. March 16th.

CLAIM.—What we claim therein, and desire to secure by letters patent, is the manner in which we have constructed and combined the respective parts of our combined metallic mould for casting butt hinges, as above set forth; that is to say, we claim the constructing of metallic moulds, so as to arrange them in tiers one above the other on each side of a metallic gate; and so as that the said mould shall contain at the time of the first casting the patterns in the form of a half hinge, divided so as to deliver readily from the cast half, as herein described. We also claim the manner of combining these moulds so as that the lower side of the pieces F shall constitute the half mould for each hinge in the series; and likewise the so forming and arranging them as to render them capable of being reversed for the purpose of casting the second half of the hinge; the whole being formed, constructed and operating substantially as herein fully made known.

Improvement in Clamps for Crimping Leather for Boots. By JOSIAH M. READ, Boston, Mass. March 16th.

CLAIM.—The main improvement or feature in my invention to which I lay claim, is the method above described of securing the ends of the leather between the clamps or jaws by means of a wedge passing under a notch or shoulder or other similar contrivance, formed in a stud connected to one of the clamps and projecting through the other; the whole being arranged and operating substantially as herein before set forth.

Improvement in the mode of Harvesting Grain. By ALFRED CHURCHILL, Geneva, N. Y. March 16th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the method herein described of gathering and threshing grain at the same time by means of the revolving rods, or oscillating or revolving cap constituting the gatherer, in combination with the thresher and concave; the whole being constructed and operating substantially in the manner set forth.

Improvement in Gas Lamps for conducting Gas from an elevated Burner to one below it, &c. By ROBERT CORNELIUS, Philadelphia, Pa. March 18th.

CLAIM.—What I claim as constituting my invention in the within described apparatus, is the manner in which I have formed the mercury cup within the body of the burner of brass or of other metal, by lining the same with sheet iron, and having the jet affixed therein; and in combination therewith, the so constructing the upper end of the descending tube as to enable it to receive and contain the jet, and thus to obviate the necessity of its removal, when said descending tube is to be used; the whole apparatus being constructed substantially in the manner herein set forth.

Improvement in the Machine for Boring War Rockets. By ALVAN C. GOELL, Washington, D. C. March 18th.

CLAIM.—I limit my claim to the particular manner in which I have adapted the instrument to the purpose of boring out war rockets and of collecting and preserving the composition with which the rocket was charged; that is to say, I claim the combining with the borer C, the cup or basin D, on the shaft B, so as to bore out and collect the material from a rocket placed in a holder or sliding frame E E; the whole being combined, connected and operating as herein set forth.

Improvement in the machine for Mortising. By JAMES KING, Morristown, N. J. March 18th.

CLAIM.—What I claim therein, and desire to secure by letters patent, is the manner of applying and using the spiral spring on the handle F, for confining the chisel in any desired position; and likewise the manner of applying a spiral spring, for returning the slide and chisel, in combination with a mortising machine such as is herein described, the whole operating substantially as set forth.

Improvement in the apparatus for Filing Saws. By NELSON J. WEMMER, Philadelphia, Pa. March 18th.

CLAIM.—What I claim as my invention in the within described apparatus, is the use of the block F, in combination with the tube E passing through it, which tube receives the point of the file as set forth. I also claim the combining with such a block, and its appurtenances, the graduated piece H, in the manner and for the purpose set forth.

Improvements in the Machine for Crosscut Sawing. By HARVEY BURGER, Danville, Ind. March 18th.

CLAIM.—All that I claim as my invention and desire to secure by letters patent, is the vertical sliding frame, provided with cords or ropes, and counter weights, in combination with the horizontal gate which slides in it, for the purpose and in the manner specified.

Improvement in Puddling Furnaces for manufacturing Iron with Anthracite Coal. By THOMAS COOPER, New-York. Patented August 25th, 1840. Reïssued March 18th, 1841.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is constructing the floor of the fire chamber with a grate in the centre, or other arrangement substantially the same as set forth, surrounded by a dead-work for protecting the masonry of the chamber and the furnace, all as described. I also claim combining two or more heating chambers and puddling chambers with the dead-work and grate as described, in one furnace; and lastly, I claim constructing this combined furnace with a vertically descending flue, in the manner and for the purpose set forth.

Improvement in the Machine for making Pins. By JOHN J. HOWE, Derby, Ct. March 24th.

CLAIM.—Though many of the individual parts of the machine herein described are the common elements of machinery heretofore in use, and although there are some of the parts and minor combinations employed in said machine which have heretofore been used in the process of making pins, or which pertain particularly to machinery for making or assisting to make pins—to the invention of which parts and minor combinations I make no claim—yet I consider the general combination of machinery herein described constituting a self-acting machine for converting wire into completely formed pins, as a new and improved machine for said purpose; and I accordingly claim as my invention, and wish to secure by letters patent, the machine before described.

And I also claim as my invention, and wish to secure by letters patent, several of the subordinate parts or minor combinations, herein described, which are embraced in the aforesaid combination, without reference to the particular general arrangement of the machine in which said parts or combinations may be employed, in their application to the purpose of making pins, viz:

1. The combination herein described of parts for receiving the wire for the pin, from the feeder, holding the pin in the operation of pointing, and releasing the pin after the point has been completed; the parts whereof are marked in the drawings with the following figures and letters of reference, viz: 28, 29, 30, 30*d*, 31, 32, 33, 33*d*, 34, 35, 36*d*, 36*b*.

2. The table D, in connection with other parts, constituting together the combination herein described of parts for conveying the pins by successive stages from the feeder where the wire is received, by the pointing chucks, to the position wherein the pins are withdrawn from said chucks by the first carrier; and for turning round said chucks,

holding the pins in the manner before described, in the successive operations of pointing the pins; which parts are marked in the drawings with the following letters and figures of reference, viz: *c*, *h*, 25, *g*, 26, *e*, *f*, *D*, *d*, (1 to 8) *A*6, 27, 28, (*a* to *h*) 37 *M*.

3. The combination, herein described, of parts for producing the combined movements of the circular file 38, by which the points of the pins are formed, in the manner explained in the preceding description, which combination is represented, and the parts thereof are marked in the drawings with the following letters and figures of reference, viz: *C*, *k*, *l*, 62, 63, 65, *j*, 48, (*a* and *b*) 47, 46, 40, 38, 43, 44, 45, 60, *A* 9, 64, 50. But I do not claim as my invention the combination herein described for adjusting the position of the ways 48, the parts of which are marked in the drawings with the following marks of reference, viz: 52, 52*a*, 48*c*, 55, 59*a*, 59*b*, 58, 57.

4. The combination of parts, herein described, for withdrawing the pins from the pointing chucks, and carrying and introducing them between the griping dies, which is represented in the drawings, and the principal parts whereof are marked therein with the following letters and figures of reference, viz: 67, 68, 69, 65, 72, 73, 76, 78, 80, *p*, (1 to 4) *C*, *q*, (1 to 4) 83, 81.

I do not claim as my invention any of the parts or minor combinations herein before described, for feeding in or cutting off the wire; for upsetting the heads of the pins, or compressing them between finishing dies, or for getting the pins out of the die 116, after the head is finished. I do not claim the yoke 125, nor the lever 127, nor any part of the combination or arrangement by means of which they contribute to expel the pin from the die 116; nor the claw 130, for drawing the pin entirely out of said die; nor do I claim any individual parts of said machine if detached therefrom, nor any minor or subordinate combinations into which said general combination may be subdivided, for performing portions of the total operation of said machine, excepting the parts or subdivisions thereof which are specified and pointed out in the foregoing claims. And I make no claim to the invention of or to the exclusive privilege of making solid-headed pins such as are made by the machine herein described.

Machine for cutting Square Joint Dovetails. By WILLIAM PERRIN, Lowell, Mass. March 24th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the arrangement of the carriages, one moving at right angles to the motion of the other, in combination with cutters arranged with their axles inclined, as herein described.

Improvement in Rotary Steam-Engines. By JESSE TUTTLE, Boston, Mass. March 26th.

CLAIM.—What I claim, and desire to have secured by letters patent of the United States, is the improvement of rotary engines by a combination not heretofore known; the said combination consists of the method of operating the abutment valves 9, by means of the branched or forked connecting rods 10, having at each of their extremities a pin projecting

at right angles into the outer shell or case, and operated upon by the cam 8, upon the side of the rotating plate 5, as herein set forth, and the constructing of the steam chamber 12, and 20, on each side of the rotating plate 5, as described, connected with apertures 13, 14, in said rotating plate 5 and shaft 6, at 21, Fig. 5, for conducting the steam to and from the piston 7, in combination with the side pipes 15, and slide valve 19; the whole being combined, constructed and arranged as herein set forth.

Improvement in the mode of constructing Fireplaces and Chimney Stacks in Buildings. By HENRY SAWYER, New-York. March 26th.

CLAIM.—What I claim as my invention, and desire to secure by letters patent, is the mode of constructing a foundation for chimneys in buildings where no chimney stack has been constructed below, by turning the arch of the hearth at its inner end, on an iron or other metal shoe, secured to trimmer pieces on either side; said shoe being supported on a column or pier, which column or pier rests upon the sill course or wall below, or foundation wall of the building, the whole being constructed and operating as herein specified.

Improvement in the machine for Excavating Ditches. By GEORGE W. CHERRY, Washington, D. C. March 26th.

CLAIM.—What I claim as my invention and improvement, and which I desire to secure by letters patent, is—

1. The manner of moving the machine forwards by means of the cams attached to the arms of the inclined wheel, acting on the arm attached to the vibrating axle, and by the arms and pawls communicating motion to the ratchet wheels, as described; but it will be remembered that I do not claim the method of giving a forward motion to the machine simply by means of the ratchet wheels and pawls, except as above limited.

2. The connection of two or more arms to the inclined axle by means of hinges, so as to raise them from the ditch, as specified.

3. The method of guiding the machine by means of the grooved guide wheel, in combination with the movable rail track, as described.

Improvements in Life and other Boats. By JOSEPH FRANCIS, New-York. March 26th.

CLAIM.—What I claim as my invention, and wish to have secured by letters patent of the United States, is the application of air or gas chambers, or other agent, as a buoyant power, below the line of the keel of boats and vessels, and also in the run and entrance (or ends of the boat) below the keel, called sheet cylinders, in combination with the improvement in the model, forming a double bottom or low bilges on each side of the keel, which I claim also separately for all boats and vessels with or without buoyant power, a true and correct description of which is herein substantially set forth.

Improvement in Rotary Steam-Engines. By JAMES JAMIESON CORDES, citizen U. S. and EDWARD LOCKE, Newport, England. Patented in England July 18th, 1840; in the United States, March 29th, 1841.

CLAIM.—Having now described our new rotary engine, we the said James Jamieson Cordes and Edward Locke do hereby declare that the new invention whereof the exclusive use to be granted to us by the said letters patent, consists in the new rotary engine herein before described, the distinguishing character of which is, that a revolving wheel is inclosed within an exhausted box or case, and impelled and turned rapidly round by a continual current of steam, entering with force and velocity into the exhausted space wherein the wheel is situated, and impinging against suitable vanes at the circumference of such wheel, in the direction of a tangent to that circumference; the said box being connected by an eduction pipe, with a condenser, which is kept cool by means of cold water, so as to exhaust the steam from the box, at that part of the circumference of the said box where the steam ceases to act against the vanes; and that condenser having an air-pump capable of continual action, in order to keep up the exhaustion within the condenser.

Improvement in the mode of Regulating the Pressure of Steam. By FRANCIS R. TORBET, Paterson, N. J. March 29th.

CLAIM.—I do not propose to confine myself to the particular mode herein exhibited, of transmitting the motion of the piston to the valve, nor yet to the form of the valve, which may be prismatical or cylindrical, while the beam or lever may be supported at either one end or the other, instead of between the piston and valve, and the ball or weight may be placed directly upon the piston rod.

I do not claim as my invention any parts of the machine as new in mechanics, nor as involving a new or peculiar motion, but do claim as my invention, and not previously known, nor used, the general arrangement of the machine herein described and set forth, for the purpose of regulating the pressure of steam and other fluids confined in pipes and other receptacles, by means of a piston moved by the pressure of the fluid itself, and communicating its motion to a slide valve, so as to reduce the aperture through which such fluid (but under greater pressure) is admitted.

Improvements in the Machine for making or manufacturing Pipes and Tubes from Lead or other metallic substance. By BENJ. and HENRY B. TATHAM, Philadelphia, Pa. assignees of JOHN and CHARLES HANSON, of Huddersfield, England. Patented in England August 31st, 1837; dated in U. States March 29th, 1841.

CLAIM.—What we claim as our invention, and desire to secure by letters patent, are—

1. The manner set forth of making pipes or tubes of lead or other suitable metals, by pressing or driving with great force the metal while warm though not fluid, but in a 'set' or *solid state*, through the apertures, arms or divisions of the holder or bridge I, and so causing the metal to reünite around the core under the pressure, after passing the bridge.

2. The plan of feeding the cylinder through the aperture in the upper end, or side of the cylinder opposite to the dies, and closing the aperture by the entry of the piston, in combination with the reversed arrangement of the cylinder and piston, as particularly set forth, for the advantage of discharging the pipes downwards, and for other important facilities and purposes described.

3. The conical form of the chamber between the bridge and the dies, by which the metal is constricted in its passage under the pressure.

4. The combination of the guide piece I, with the long movable core attached to the piston, in the manner and for the purposes described.

5. The adaptation of the improved parts, by which several lengths of pipe may be made at one and the same time and operation.

6. The mode of constructing the piston, by which the packing is forced outwards against the inside of the cylinder by the pressure of the face or end of the piston against said packing, as described.

Improvements in the manner of constructing and arranging Paddle Wheels for propelling Vessels. By Wm. W. Van Loan, Catskill, N. Y. March 29th.

Claim.—What I claim therefore as constituting my improvement, and desire to secure by letters patent, is the placing of the said wheels in the position herein fully made known and represented, so that they shall enter and leave the water in a direction similar to that of oars in the ordinary process of rowing, the whole operating substantially in the manner described.

Improvement in the Wheel for propelling Steam Ships, which may be employed as a Wind or Water Wheel for Mills. By John Hobday and Wm. J. Cocke, Portsmouth, Va. March 29th.

Claim.—What we claim as our invention, and desire to secure by letters patent, is the introduction of a crank into a wheel, which at the same time that it gives a new centre to the paddles or arms, it enables them to protrude in time of action, and recede when not wanted for action, and at the same time makes the periphery of the wheel the forcing power on the arms or paddles, and enables the constructor to make a wheel of the most powerful form.

Improvement in the Machine for Excavating Earth. By D. C. Lockward, New Windsor, N. Y. March 31st.

Claim.—What I claim as my invention, and desire to secure by letters patent, is the described mode of letting the dirt off from the wheel by lifting the stop boards which form the inner curb of the periphery, and also the described arrangement by which the supporting wheel is brought within the inner edge of the upper part of the periphery of the inclined wheel so as to allow a cart, &c. to receive the earth directly from the emptying stop boards.

Improvement in the Machine for Splitting Palm Leaf. By Cory McFarland, Barre, Mass. March 31st.

Claim.—I do not in this specification claim as my invention the me-

thod, above described, of splitting palm leaf by means of the grooved rollers and knives; but what I do claim, and desire to secure by letters patent, is the arrangement of the guides I and L, for separating the waste and worthless fragments of the leaf, as described above, and also the combination of the squaring box P, and receiving box O, for throwing all the pieces of palm leaf, when split, into a proper position for bundling, as herein described.

Improvement in Cotton Presses. By Wm. C. Van Hoesen, Catskill, N. Y. April 2d.

Claim.—What I claim as my invention and improvement, and which I desire to secure by letters patent, is the combination of the power and scroll wheels, with the chain and follower of the press; the whole being constructed as herein set forth, or in any other manner substantially the same.

Improvement in Current Water Wheels, being a plan for giving increased power to such Wheels. By Noadiah W. Hubbard, Randolph, Portage county, Ohio. April 2d.

Claim.—I am aware that the force of the current to be thrown upon a wheel has been increased by shoots placed at an angle with the axis of the wheel, so as to concentrate the current upon it, and this I do not therefore claim as my invention; but what I do claim as my invention, and desire to secure by letters patent, is the employment of two or more sets of shoots or regulators, in combination with a spiral wheel, so as to throw the current upon different parts of the thread or spiral along its length, substantially as herein described.

Method of Wetting Flannels and other Cloths. By Joseph W. Hale, Haverhill, Mass. April 2d.

Claim.—What I claim as my invention, and desire to secure by letters patent, is the combination of the tank F, the valve G, (regulated by the weight W) the rollers U, Y and S, and the colander H; the whole being constructed and operated as herein described.

Improvements in Machinery for Cutting Crackers. By Wm. Perkins, Boston, Mass. April 2d.

Claim.—Having thus described my invention, I shall claim in the same, the arrangement of machinery which gives motion to the feed rollers and endless apron, in combination with the arrangement of machinery which operates the stamping apparatus; the whole being constructed substantially in the manner and for the purposes herein before described. I also claim operating the feed rollers and endless apron so that they may be alternately at rest and in motion, by means of a geared pinion, (having a portion of the teeth of its circumference removed) in connection with the other machinery intervening between said pinion, feed rollers and apron; also operating the stamping apparatus by means of a cam or cams in connection with the toggles and other intervening machinery; the whole being constructed and arranged substantially as above set forth.

Improvement in the Blacksmith's Tuyere, by which the blast is heated, and the top of the Tuyere made to serve as a Hearth for the Forge. By ELIAS KAIGHN, Kaign's Point, Gloucester co. N. J. April 2d.

CLAIM.—What I claim as my improvement, and wish to secure by letters patent, is the construction of the tuyere with a flue surrounding the ash-box B, in combination with said ash-box, as set forth; also, in combination with the foregoing, the arrangement of the upper surface of the tuyere as the hearth of the forge, and the perforated cover E for admitting air to the flame, &c. all as set forth.

Improvement in Cattle Pumps. By SHIVELY STADON, Greenwood, Columbia county, Pa. April 2d.

CLAIM.—What I claim therein, and desire to secure by letters patent, is the manner in which I have arranged and combined the movable platform, the vertical ratchet and the pawls so as to give a reciprocating motion to the rod K, as set forth, by means of the weight of cattle standing upon said movable platform. I also claim the combination of parts by which the stroke of the piston or pistons is augmented, by any additional weight upon the movable platform; that is to say, I claim the causing of said platform to operate upon the sliding rod L, and the reciprocating rod K, substantially in the manner and for the purpose described; not intending however by said description to limit myself to the special form and arrangement herein designated, but to vary these in such way as I may find expedient, whilst the same effects are produced by analogous or equivalent means.

Improvement in the method of treating Reducible Hernia, by which adhesion of the Hernial Sac is produced, and a Radical Cure effected. By ZOPHAR JAYNE, Carrollton, Greene county, Ill. April 2d.

CLAIM.—What I claim as my invention or discovery, and desire to secure by letters patent, is first, the injecting into the hernial or peritoneal sac, or into the common cellular membrane or parts in, at, or about the abdominal or femoral rings or openings, wherever the hernia may occur, of an essential or other stimulating or exciting fluid, for the purpose herein fully set forth, whether the same be done or injected by means of the syringe herein described, or by any other instrument adapted to that purpose; and secondly, I claim the constructing and using of a syringe for the above purpose, having a sharp-pointed beak and a lateral opening therein, substantially as described.

Improvement in apparatus for Heating Water, Steaming Vegetables, &c. By ASA MUNGER and JAMES S. MARSH, Auburn, N. Y. April 2d.

CLAIM.—We do not claim to be the inventors of the worm in the fire chambers, nor of the combination of the tub and boiler, without the worm; but what we do claim as our invention, and desire to secure by letters patent, is the combination of the worm in the fire-chamber with the boiler and tub, for the purpose and in the manner set forth and specified above.

Improvement in the mode of forming the Joint on the End Pieces of the Frames of Spectacles. By JOHN ELTONHEAD, Baltimore, Md. April 2d.

CLAIM.—What I claim as my invention in the within described spectacle frames, is the manner of constructing the joint by which the pieces A A are connected with the side or temple pieces B B, the pieces A A being left solid or undivided, as set forth, and the hole for the joint pin on the pieces B B being also drilled out of the solid metal.

Improvement in the mode of manufacturing Corsletts for Medicinal and other purposes. By ALANSON ABBE, Worcester, Mass. April 2d.

CLAIM.—That which the said Abbe claims as new and as his invention, is the mode of manufacturing corsletts for forming them of any suitable material upon a mould, or between double moulds, as above specified.

Improvement in Cheese Presses. By JOB ARNOLD, Harmony, Chautauque county, N. Y. April 2d.

CLAIM.—What I claim as my improvement, and wish to secure by letters patent, is the combining of two sets of levers, one set being arranged above the follower, and the other below the movable bed or press bottom, with the aforesaid follower and movable bed and said levers, being connected and operated as herein set forth.

Improvement in Rotary Steam-Engines. By ISAAC N. WHITTLESEY, Vincennes, Knox co. Ind. April 2d.

CLAIM.—What I claim therein as constituting my invention, and which I desire to secure by letters patent, is, first, the manner of protruding the valves B B by the elastic force of the steam, acting behind them by an arrangement of parts substantially the same with that herein set forth; said arrangement consisting of the partition *c c*, the stops *d d*, the apertures H and I, combined with the valves B, and their appendages, and operating in the manner described; secondly, the manner of reversing the motion of the engine by the shifting or vibrating of a piece of metal, constructed, connected and operating in the manner of that marked N, in the foregoing specification.

LIST OF ENGLISH PATENTS

GRANTED BETWEEN THE 23D OF FEBRUARY AND THE 22D OF MARCH, 1841.

George England, of Westbury, Wiltshire, clothier, for improvements in machinery for weaving woolen and other fabrics, and for twisting, spooling and warping woolens, also for improvements in the manufacture of woolen doeskins. March 2; six months to specify.

John Wilkie, Nassau-street, Mary-le-bone, upholsterer, and John Charles Scheviess, of George-street, St. Pancras, musical instrument maker, for improvements in constructing elastic seats or surfaces of furniture. March 2; six months.

Henry Newton Brewer, of Jamaica Row, Bermondsey, mast and block maker, for an improvement or improvements in wooden blocks for ships, rigging, tackles, and other purposes where pulleys are used. March 3; six months.

John Rand, of Howland-street, gentleman, for certain improvements in machinery for the manufacture of framework knitting or hosiery. March 6; six months.

Thomas Spencer, of Liverpool, carver and gilder, for an improvement or im-

provements in the manufacture of picture and other frames, and cornices applicable also to other useful and decorative purposes. March 8; six months.

John Varley, of Bayswater Terrace, Bayswater, artist, for an improvement in carriages. March 8; six months.

John William Neale, of William-street, Kensington, engineer, and Jaque Edouard Duyck, of Swan-street, Old Kent Road, commission agent, for certain improvements in the manufacture of vinegar, and in the apparatus employed therein. March 8; six months.

Benjamin Smith, of Stoke Prior, near Bromsgrove, butcher, for an improved apparatus for making salt from brine. March 8; six months.

John Walker, of Crooked-lane, King William-street, for an improved hydraulic apparatus. March 8; six months.

Richard Lawrence Sturtevant, of Church-street, Bethnal Green, soap manufacturer, for certain improvements in the manufacture of soap. March 8; six months.

Thomas Joseph Ditchburn, of Orchard House, Blackwall, shipbuilder, for certain improvements in ship building, some or all of which are applicable to steam-boats, and boats, and vessels of all descriptions. March 8; six months.

Anthony Todd Thomson, of Hind-street, Manchester-square, doctor of medicine, for an improved method of manufacturing calomel and corrosive sublimate. March 8; six months.

Stephen Goldner, of West-street, Finsbury Circus, merchant, for improvements in preserving animal and vegetable substances and liquids. March 8; six months.

John Wertheimer, of West-street, Finsbury Circus, printer, for improvements in preserving animal and vegetable substances and liquids. (A communication.) March 8; six months.

Thomas Clark, professor of chemistry in Mareschal College, Aberdeen, for a new mode of rendering certain waters (the water of the Thames being among the number) less impure, and less hard for the supply and use of manufactories, villages, towns and cities. March 8; six months.

John Baptist Fried Heimann, of Ludgate Hill, merchant, for improvements in the manufacture of ropes and cables. (A communication.) March 8; six months.

John Dockree, of Galway-street, St. Luke's, gas fitter, for an improvement or improvements on gas burners. March 15; two months.

Richard Laming, of Gower-street, Bedford-square, surgeon, for improvements in the production of carbonate of ammonia. March 15; six months.

William Newton, of Chancery-lane, civil engineer, for improvements in machinery or apparatus for picking and cleaning cotton and wool. (A communication.) March 15; six months.

Robert Warington, of South Lambeth, Surrey, gentleman, for improvements in the operations of tanning. March 16; six months.

Joseph Maudslay, of Lambeth, Surrey, engineer, for an improvement in the arrangement and combination of certain parts of steam-engines to be used for steam navigation. March 16; six months.

William Newton, of Chancery-lane, civil engineer, for improvements in spinning and twisting cotton, and other materials capable of being spun and twisted. (A communication.) March 16; six months.

George Lowe, of Finsbury Circus, engineer to the chartered gas company, for improved methods of supplying gas under certain circumstances, and of improving its purity and illuminating power. March 16; six months.

Charles Bunt Dyer, of Pary's Mine, Anglesea, mine agent, for an improved method of obtaining paints or pigments by the combination of mineral solutions and other substances. March 16; six months.

Laurence Kortright, of Oak Hall, East Ham, Essex, esquire, for certain improvements in treating and preparing the substance commonly called "White Bone," and the fins and such like other parts of whales, and rendering the same fit for various commercial and useful purposes. (A communication.) March 17; six months.

William Thompson Clough, of St. Helens, Lancaster, alkali manufacturer, for improvements in the manufacture of the carbonates of soda and potash. (A communication.) March 17; six months.

Henry Augustus Wells, of Regent-street, gentleman, for improvements in machinery for driving piles. (A communication.) March 17; six months.

Joshua Field, of Lambeth, engineer, for an improved mode of effecting the operation of connecting and disconnecting from steam-engines the paddle-wheels used for steam navigation. March 22; six months.

Richard Barnes, of Wigan, Lancaster, engineer, for certain improvements in machinery or apparatus for raising or drawing water or other fluids. March 22; six months.

Anthony Theophilus Merry, of Birmingham, refiner of metals, for an improved process or processes for obtaining zinc and lead from their respective ores, and for the calcination of other metallic bodies. March 22; six months.

Robert Walter Winfield, of Birmingham, merchant and manufacturer, for certain improvements in or belonging to metallic bedsteads, a portion of which may be applied to other articles of metallic furniture. March 22; six months.

Robert Goodacre, of Ullesthorpe, Leicestershire, for an improved mode of weighing bodies raised by cranes or other elevating machines. March 22; six months.

David Napier, of Mill Wall, engineer, for improvements in propelling vessels. March 22; six months.

Achille Elie Joseph Sovitas, of George Yard, Lumbard-street, merchant, for improvements in apparatus for regulating the flow of fluids. (A communication.) March 22; six months.

William Bucknell, of Westminster, gentleman, for improvements in applying heat for the purpose of hatching eggs, which improvements are also applicable to other useful purposes where heat is required. March 22; six months.

Morris West Ruthven, of Rotheram, engineer, for a new mode of increasing the power of certain media, when acted upon by rotary fans or other similar apparatus. March 22; six months.

Robert Cook and Andrew Cunningham, of Johnstone, near Glasgow, engineer, for improvements in the manufacture of bricks. March 22; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in stretching cloths. (A communication.) March 22; six months.

Joseph Wright, of Carisbrook, Isle of Wight, mechanic, for improvements in apparatus used for dragging or skidding wheels of wheeled carriages. March 22; six months.

Thomas Wright, of Church Lane, Chelsea, lieutenant in her Majesty's Navy, for certain improvements applicable to railway and other carriages. March 22; six months.

Edward Finch, of Liverpool, ironmaster, for improvements in propelling vessels. March 25; six months.

Goldsworthy Gurney, of Bude, Cornwall, esquire, for improvements in the production and diffusion of light. March 25; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22D OF JANUARY TO THE 22D OF MARCH, 1841.

George Jamieson Cordes, and Edward Locke, of Newport, Monmouth, for a new rotary engine. Sealed. Jan. 28.

Samuel Hall, of Basford, Nottingham, civil engineer, for improvements in the combustion of fuel and smoke. Feb. 1.

John Dickinson, of Bedford-row, Holborn, Middlesex, esquire, for certain improvements in the manufacture of paper. Feb. 1.

William McMurray, of Kinleith Mill, near Edinburgh, paper maker, for certain improvements in the manufacture of paper. Feb. 3.

William Henson, of Allen-street, Lambeth, Surrey, engineer, for improvements in machinery for making or producing certain fabrics with threads or yarns, applicable to various useful purposes. Feb. 4.

Nathaniel Lloyd, pattern designer, and Henry Rowbotham, calico printer, both of Manchester, Lancaster, for certain improvements in thickening and preparing colors for printing calicoes and other substances. Feb. 9.

James McLellan, of Glasgow, manufacturer, for an improved combination of materials for umbrella and parasol cloth. Feb. 9.

John Clarke, of Islington, Lancaster, plumber and glazier, being a communication from abroad, and partly by invention of his own, for an hydraulic double action force and lift pump. Feb. 9.

Charles May, of Ipswich, Suffolk, engineer of the firm of J. H. & A. Hansome & Co. for improvements in machinery for cutting and preparing straw, hay, and other vegetable matters. Feb. 12.

James Johnson, of Glasgow, North Britain, gentleman, for certain improvements in machinery for the manufacture of framework knitting, commonly called hosiery, and for certain improvements in such framework knitting or hosiery. Feb. 15.

George Holworthy Palmer, of Surrey-square, Surrey, civil engineer, and Charles Perkins, of Mark-lane, London, merchant, for improved constructions of pistons and valves for retaining and discharging liquids, gases and steam. Feb. 16.

Miles Berry, of 66 Chancery-lane, Middlesex, (a communication) for certain improvements in looms for weaving. Feb. 20.

Moses Poole, of Lincoln's Inn, Middlesex, gentleman, (a communication) for improvements in tanning. Feb. 22.

William Orme, of Stourbridge, Worcester, ironmaster, for improvements in the manufacture of cofered spades and other cofered tools. Feb. 23.

William Pierce, of Islington, Middlesex, gentleman, for certain improvements in the preparation of wool and other animal fibres, both in the raw and manufactured state, by means of which the quality will be considerably improved. Feb. 24.

Theophilus Richards, of Birmingham, Warwick, merchant, for improvements in cutting or sawing wood. (A communication from abroad.) Feb. 26.

Francis Sleddon, jun. of Preston, Lancaster, machine maker, for certain improvements in machinery or apparatus for roving, slubbing and spinning cotton and other fibrous substances. March 2.

Hugh Lee Pattinson, of Bensham Grove, near Gateshead, Durham, manufacturing chemist, for improvements in the manufacture of white lead. March 3.

Charles Cameron, esquire, lately captain in her Majesty's 18th regiment of foot, and presently residing at Mount Vernon, Edinburgh, for certain improvements in engines to be actuated by steam or other elastic fluids. March 3.

Paul Hannuic, of Paris, but now of Manchester, Lancaster, solicitor, for certain improvements in the construction of governors or regulators applicable to steam engines and to other engines used for obtaining motive power. (A communication from abroad.) March 3.

Charles de Bergue, of Sydenham, Kent, gentleman, for certain improvements in machinery for making reeds used in weaving. (A communication from abroad.) March 3.

William King Westly, of Leeds, York, flax machinist, for certain improvements in carding, combing, straightening cleaning and preparing for spinning hemp, flax, and other fibrous substances. March 6.

Robert Urwin, of South Shields, Durham, engineer, for certain improvements in sream-engines. March 9.

Walter Richardson, of Regent-street, Middlesex, and George Mott Braithwaite, of Chelsea, also Middlesex, gentleman, for improvements in tinning metals. (A communication from abroad.) March 11.

John Rand, of Howland-street, Middlesex, gentleman, for improvements in preserving paints and other fluids. March 16.

Thomas William Booker, of Melin, Griffith Works, near Cardiff, ironmaster, for improvements in the manufacture of iron. March 16.

Charles Edwards Amos, of Great Guildford-street, in the borough of Southwark, for certain improvements in machinery or apparatus used in the manufacture of paper. March 18.

William Hancock, jun. of King-square, Goswell-road, Middlesex, accountant, for an improved description of fabric suitable for making friction gloves, horse brushes, and other articles requiring rough surfaces, and the method of manufacturing the same. March 19.

Frederick Steiner, of Hyndburn Cottage, near Accrington, Lancaster, Turkey-red dyer, being a communication from abroad, for improvements in looms for weaving, and cutting asunder double [piled] cloths, and a machine for winding weft to be used therein. March 19.

Matthew Uzielli of King William-street, London, merchant, being a communication from abroad, for improvements in impregnating and preserving wood and timber for various useful purposes. March 22.

LIST OF IRISH PATENTS GRANTED FOR JANUARY, 1841.

R. E. Morrice, certain improvements in the arrangement and construction of ships' hearths or apparatus for cooking and for obtaining distilled or pure water from salt or impure water.

W. H. Burnett, improved machinery for cutting or working wood.

H. H Bourne, a machine for cleansing highways.

J. Aunes, a new and improved method of making paint from materials not before used for that purpose.